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ABSTRACT

In order to bring national focus on the lack of minority engineers, more than 250 engineers, educators, students, and representatives of minority social action groups, professional and technical societies, foundations, industry, and government met to discuss the recruitment and financial support of minority students, program financing, and the continuation of a national focus on the problem. Participants unanimously agreed to set a national goal of ten-fold increase in minority engineers within a decade by raising the annual number of graduates from 500 to 5,000. Two implementing recommendations were adopted: that the National Academy of Engineering establish a Standing Committee on Minorities in Engineering composed of educators, members of minority groups, and representatives of industry and professional-technical organizations; and that the National Academy of Engineering take the initiative in exploring with industry, government, and educators the feasibility of creating a National Council on Minorities in Engineering. Some of the other recommendations were directed at improving communications to reach minority youngsters, the use of grants and the media to recruit students, supporting Black engineering schools, and recognizing the Spanish-speaking, American Indians, and Orientals. This report discusses the recommendations; lists the participants; briefly describes 35 programs and activities at schools and in government and industry; and presents the texts of three addresses given at the symposium. (MQ)

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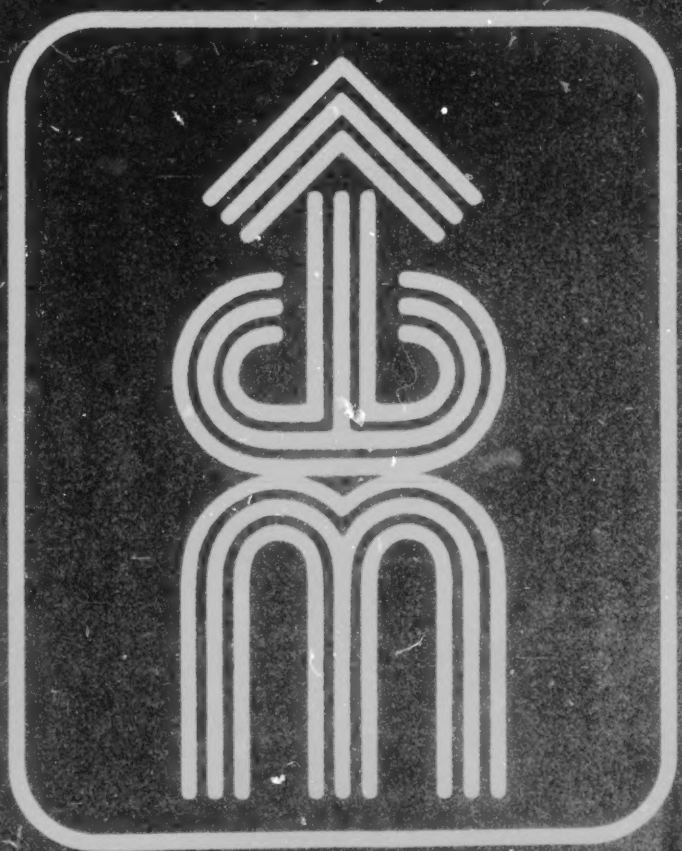
Proceedings

Symposium on Increasing Minority Participation in Engineering



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Proceedings of

SYMPOSIUM ON INCREASING MINORITY PARTICIPATION IN ENGINEERING

May 6-8, 1973

Washington, D. C.

Commission on Education

National Academy of Engineering

2101 Constitution Avenue, N. W.

Washington, D. C. 20418

NATIONAL ACADEMY OF ENGINEERING

The National Academy of Engineering was established in December 1964. The Academy is independent and autonomous in its organization and election of members, and shares in the responsibility given the National Academy of Sciences under its congressional act of incorporation to advise the federal government, upon request, in all areas of science and engineering.

The National Academy of Engineering, aware of its responsibilities to the government, the engineering community, and the nation as a whole, is pledged:

1. To provide means of assessing the constantly changing needs of the nation and the technical resources that can and should be applied to them; to sponsor programs aimed at meeting these needs; and to encourage such engineering research as may be advisable in the national interest.

2. To explore means for promoting cooperation in engineering in the United States and abroad, with a view to securing concentration on problems significant to society and encouraging research and development aimed at meeting them.

3. To advise the Congress and the executive branch of the government, whenever called upon by any department or agency thereof, on matters of national import pertinent to engineering.

4. To cooperate with the National Academy of Sciences on matters involving both science and engineering.

5. To serve the nation in other respects in connection with significant problems in engineering and technology.

6. To recognize in an appropriate manner outstanding contributions to the nation by leading engineers.

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INTRODUCTION

One of the scarcest professionals to find in American society today is the engineer who hails from an ethnic minority. The prospects are that they will continue to be scarce unless a massive national effort is made now to recruit and train many more Blacks, Puerto Ricans, Chicanos, American Indians and Asian Americans as engineers.

Lucius Walker of Howard University has reported that only one half of one percent of all the engineers in the nation were Blacks in 1970, exactly the same percentage as in 1960. In the 1971 graduating class of 43,000 engineers across the country there were only 570 Blacks and a scattering of other minorities and women--slightly over one percent of the total.*

A tragic consequence of this acute underrepresentation at the academic level was foreseen by J. Stanford Smith, in July 1972: ** "It takes about fifteen to twenty years for people to rise to the top leadership positions in industry. So if industry is getting one percent minority engineers in 1972, that means in 1990, that's about the proportion that will emerge from the competition to the top leadership positions in industry. This is a formula for tragedy. Long before the year 1990, a lot of minority people are going to think that they have been had."

While at one time racial discrimination was a major barrier against minority entry into the managerial ranks of industry, this

* There is little reliable statistical information available relating to minorities other than Blacks.

** While he was Senior Vice President of the General Electric Company.

is no longer true today. The fact is large corporations are competing to hire technically-trained minority personnel--and the demand far outstrips the supply.

We cannot ignore the broad implications of minority disenfranchisement from a role in directing and shaping the economic future of the nation. Traditionally, minority political leadership has sprung from a narrow base of professionals--chiefly teachers, labor organizers and more recently, doctors and lawyers. Until the base is widened to include industrial management as well, it will be extremely difficult for minorities to achieve full social equality. Beyond this there is simply a need for minorities to possess the professional training by which they can affect, guide and change their own lives.

We are aware that there can be no such thing as "Black engineering" or "Chicano engineering." But the recent past has shown how much better minority professionals have been able to serve their own people, especially the poor and disadvantaged, in the fields of education, medicine, the law and social welfare. We need look only to the plight of the inner cities to question whether a minority engineer might not bring some extra motivation and imagination to solving the problems of housing, transportation and public safety--an engineer with a personal reason to care that the problems are solved.

Over the past several years, the engineering profession--both academic and industrial--has shown its concern toward minorities and has exerted many efforts to attract the young to an engineering

education.

A number of engineering schools with predominantly white enrollments have undertaken active recruiting programs and are providing follow-through support for students with academic handicaps. Help has come from professional and technical societies--for example, the American Personnel and Guidance Association, American Society of Mechanical Engineers, National Council of Teachers of Mathematics, National Urban League, and the Engineers' Council for Professional Development. They have joined with the personnel of Scholastic Magazine and Science Services, Inc. in establishing task forces to locate minority student candidates for engineering, to study ways of motivating them, and to develop programs for tutoring and providing financial assistance.

Industry has mounted programs to increase minorities in the professional-managerial level. Some companies are retraining and upgrading technical employees, assisting the recruiting efforts at engineering schools, and providing scholarships for minority engineering students.

These efforts have produced some encouraging results. In the past four years, engineering school enrollments of Blacks and other minorities have risen from 2,757 students or 1.2% of the total enrollment of 233,530 in 1969-70 to 4,356 students or 2.2% of the 197,727 total in 1972-73. In 1971, the total number of freshman Blacks enrolling in engineering increased slightly more, with most of the increase at predominantly Black schools.

Even if this upward trend is maintained, however, it is still going to take many decades for Blacks to achieve parity in the mana-

gerial ranks of industry, or a Black for every nine whites, not to mention the other minorities. As Smith warned, "On the present lazy trajectory, we are postponing the arrival of significant numbers of Blacks in the top ranks of industry until well into the Twenty-First Century. To put the challenge bluntly, unless we start producing not 400, but 4,000 to 6,000 minority engineers a year within a decade, industry will not be able to achieve its goals of equality, and the nation is going to face social problems of unmanageable dimensions."

Many others familiar with the problem in industry and education have reached the same conclusion. What is being done now to attract minorities to engineering is not enough. A much stronger national effort is demanded.

On the basis of this obvious necessity to bring national focus on the problem the Commission on Education of the National Academy of Engineering offered to plan and conduct a Symposium on Increasing Minority Participation in Engineering. The Commission developed a proposal for such a symposium and received NAE approval to seek funding. On May 6-8, 1973, at the Academy's headquarters in Washington, D. C., the Symposium was held under the aegis of the National Academy of Engineering and the Commission on Education. It was attended by more than 250 participants including engineering educators and students from both predominantly white and predominantly Black schools, representatives of minority social action groups, professional and technical societies, foundations, industry and government.

The Symposium objective, simply put, was to assemble the best minds among those most closely associated with the problem and let

them exchange information to develop recommendations as to the most effective short-and long-range strategies for action by all concerned. It should be noted here that the Symposium did not succeed in gaining sufficient representation of some Spanish-speaking and American Indian groups. Only one Asian-American was present. And because we were obliged to limit the size of the meeting we were unable to invite as many representatives of elementary and secondary education as would have been desirable.

Despite these oversights, it was felt the Symposium was able to deal constructively with the problems at hand, namely: how to recruit more qualified and qualifiable minority students into engineering; how to provide better in-college support for these students; how to finance these programs; and, most importantly, how to maintain a continuing national focus to assure that a major increase in minority participation in engineering is achieved.

The results of the Symposium's two days of deliberations can be found in the ensuing summary.

Keynote speakers included Dr. Myron Tribus of Xerox, a member of the National Academy of Engineering at the opening session; Dean Percy Pierre, Howard University on Monday morning, May 7; Senator Hubert Humphrey at lunch on May 7; Representative Barbara Jordan at dinner on May 7; and NAE President Robert C. Seamans on May 8. Dean John G. Truxal of the State University of New York School of Engineering, Stony Brook, wrapped up the Symposium with a stimulating challenge to the Academy to take positive action <u>now</u>.

The Symposium was enriched by a number of invited resource papers as follows:

Recruiting

Identification and Location of Minorities
Mr. Calvin H. Conliffe
General Electric Company

Constraints to Recruiting
Professor Gordon L. Berry
University of California at Los Angeles

Mechanisms and Organizations for Recruiting
Professor Melvin Thompson
Newark College of Engineering

Minority Students in Engineering Schools

3-2: Georgia Institute of Technology
Professor F. W. Schutz, Jr.
Georgia Institute of Technology

School with Predominantly Minority Enrollment
Dean M. Q. Burrell
Southern University

Large School, Predominantly White
Mr. Willie J. Nunnery
University of Wisconsin at Madison

Urban School
Dr. Irvin B. Miller
University of Houston

Junior/Community Colleges
Dr. Stephen J. Wright
College Entrance Examination Board

Financing a Program

Schools with Predominantly Minority Enrollment
Dean Reginald L. Amory
North Carolina Agricultural and Technical State University

Schools with Predominantly White Enrollment
Mr. Donald G. Dickason
Cornell University

Industry, Private Foundations
Dr. David Moore
The Conference Board

Government
Dr. Peter P. Muirhead
U. S. Office of Education

Some of these papers are available on request from the Commission on Education.

It was a personally rewarding experience to work with Symposium Planning Committee Chairman Pierre; with topic chairmen, Mr. David Ford, Dean Thomas L. Martin, and Dean Willie Carter; and with workshop chairmen, Professor Neville Parker, Mr. Carson Carr, Mr. Willie Nunnery, Dr. Irvin Miller, and Dr. John L. Martinez.

The Commission on Education wishes to acknowledge the generous support of Alcoa, E. I. duPont de Nemours, Exxon, General Electric Company, IBM, Olin Corporation, Alfred P. Sloan Foundation and Xerox in helping to finance the costs of the Symposium.

Finally, special recognition should be extended to Mrs. Jean P. Moore, and others on the Commission staff for the outstanding and extremely competent organizational work and planning that resulted in a highly successful meeting.

W. Robert Marshall, Chairman
Commission on Education

September 1973

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The Symposium Planning Committee is deeply indebted to Dr. Lawrence N. Canjar, Chrysler Professor and Dean of the College of Engineering, University of Detroit, who was a dedicated member of the Committee and active in the planning of this Symposium until his untimely death in November, 1972.

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* Affiliations shown are as of the date of the Symposium.

Summary of Proceedings

SYMPOSIUM ON INCREASING MINORITY PARTICIPATION IN ENGINEERING

THE GOAL: A TEN-FOLD INCREMENT

Members of the Symposium, meeting in a final plenary session, agreed unanimously to establish a national goal of achieving a ten-fold increase in minority engineers within a decade, by raising the annual number of minority engineering graduates from 500 to 5,000.

There was a consensus that this was a reasonable goal, provided the necessary resources could be marshalled on the national and regional level.

Two implementing recommendations were adopted:

1. That the National Academy of Engineering establish a Standing Committee on Minorities in Engineering composed of a cross section of Symposium delegates to include engineering educators, members of minority groups and representatives of industry and professional-technical organizations.

2. That the National Academy of Engineering take the initiative in exploring with industry, government, and educators the feasibility of creating a National Council on Minorities in Engineering.

The rationale for these actions on the part of the Academy was that the primary responsibility for solving the many complex academic and financial problems associated with increasing minority engineering enrollments rests with the engineering profession itself. Because the Academy's membership does embrace all elements of the profession on the national level, it is the logical mechanism to play a facilitating and leadership role in seeing that continuing attention is focused on the problem and that the goal is attained.

Members of the Symposium also agreed unanimously that the predominantly Black engineering schools are an essential ingredient in the national educational structure and to the achievement of the goals of the Symposium. Their expansion and improvement must be secured promptly through broadly-based, long-term programs of financial support from government, industry, and foundations, to significantly increase engineering enrollments on those campuses.

In addition, there were a number of other significant recommendations directed to government, industry and the predominantly white schools of engineering. The details of these recommendations follow.

DISCUSSION OF THE RECOMMENDATIONS

In the recommendation by David Ford proposing creation of a National Council on Minorities in Engineering, it was first suggested that industry assume this responsibility. Dean Willie Carter said the thinking was that the "... most effective group to implement the Council was the Minority Engineering Education Effort (ME^3) Task Force,"* an organization recently formed by industry, engineering schools and major engineering professional-technical societies.

"We felt at this time as far as laying the ground rules, a blueprint for any national council, should be entrusted to ME^3," Carter added. "Also we felt the prestige of the National Academy of Engineering must be maintained throughout the development of this national council. In addition, we believe that an advisory body must be created consisting of industry people at the chairman-

* For description, see Appendix III, page 92.

of-the-board or president level, coupled with presidents and chancellors of universities. Above all this group must put its signature or blessings on what we are talking about here today--a ten-fold increase in minority engineers. This may be done by way of guaranteeing jobs and a monetary commitment toward this idea."

Objections were raised by some delegates that industry itself was too broad and diffuse to assume the task. The responsibility would not be pinpointed. Ed Butenhof of Eastman Kodak commented, "No one company is big enough or has enough money and so on to carry the coordination load all by itself, nor probably would they want to. It was suggested in our workshop group that this coordination could be done by the National Academy of Engineering or the American Society for Engineering Education, which expressed a willingness to do it through one of its representatives." David Ford suggested "... think about NAB--The National Alliance of Businessmen..., not in terms of actually assuming the task, but as a model of an organization that could." Elmore Holerman of the Engineering Council of Sacramento Valley recommended that the industries which helped sponsor the Symposium form the nucleus of an implementing organization.

Symposium Chairman W. Robert Marshall resolved the issue by suggesting the recommendation be re-worded to remove "... the word industry and simply say, 'There should be organized a National Council.' And the question of where it is done can be decided," by the Academy and by participants of the Symposium.

Several speakers, including Dr. Myron Tribus* and Senator Hubert H. Humphrey*, addressed the economic and social implications

* See Appendix IV, Pages 93 and 116.

resulting from the current extreme lack of minority engineers. In the workshops, Symposium delegates were more concerned with discussing specific issues and proposing solutions. As David Ford expressed it, "If I could speak for all Black people who have been out here in engineering for these years, I could speak to you of many hard trials, of many scars. But I would ask you, that's past. The only thing about the history--thank God, it's over. Our concern is for the future, what we are trying to do here. We must see the importance. It's bigger than any one of us."

In addition to establishing an overall goal and the means for maintaining a continuing effort, the Symposium was organized around three supporting themes:

1. *Recruiting: How can a much greater commitment be made to find, motivate, support, and guide qualified and qualifiable students toward engineering careers?*

2. *In-College Support: What are the special supportive programs that college administrators and faculty must devise and sustain to see minority students through engineering courses, academically and financially?*

3. *Program Financing: What are the costs of expanding enrollments in predominantly minority engineering schools and bringing more minorities into predominantly white schools?*

Following are the major recommendations of the Symposium workshops in these areas:

RECRUITING RECOMMENDATIONS

Numerous recommendations generated by workshop participants were directed at elementary and junior high schools, improving communications to reach minority youngsters, industry involvement, the use of grants and the media to assist in recruiting students.

Schools: A national survey should be conducted of all students in the seventh and eighth grades to determine interests in math and the sciences. The target group that emerges should be sent mailings telling of opportunities in physical sciences and engineering, then resurveyed at the eleventh grade and particular attention given to minority students interested in engineering.

Consortia of high schools should be formed, or polytechnic schools organized, to develop a quality pre-engineering math-science program; summer institutes should be established for inner city junior and senior high school math and science teachers and counselors to inform them of the meaning of engineering careers for minorities.

Communications: Establish at least ten regional coordinating commissions among engineering societies, engineering schools and industry. These commissions should develop comprehensive engineering awareness programs directed at minority students beginning in the seventh grade.

Employ ME^3 as the nucleus of a national program to identify not only academically qualified but qualifiable minority candidates for engineering.

Create a National Clearinghouse to register students interested in engineering careers; also develop national registries of minority and women students who are in undergraduate engineering programs to assist their recruitment into graduate programs.

Industry: Private companies should assist in identifying secondary school students with engineering career potential and help motivate them to go to college; provide a realistic perspective to potential engineering candidates on the difficulties of obtaining

an education and the career opportunities that lie ahead; assist with financial aid; make personnel available to work in the secondary school systems with teachers in developing math-science courses.

Grants: Create a national scholarship program for minority students who want to be engineers; reestablish merit scholarships for minorities; have local engineering societies develop minority scholarship programs.

Media: Industry should commit a substantial fraction of its general and institutional advertising budgets, primarily through the medium of television, to publicize the need for engineers. It also should sponsor dramatic shows highlighting minority engineers and the opportunities and challenges they face in real life.

Produce a series of films on engineers for public media presentation to dispel the image of engineers as out-of-work polluters and show them as people sought after as problem-solvers. Objective: educate students and the general public about engineering. (MIT has started such a series with the first film, *"Energy in the Year 2000,"* and a second, *"Women in Engineering."*)

IN-COLLEGE SUPPORT RECOMMENDATIONS

The predominantly white universities must each make a fundamental commitment to the minority program in engineering. This commitment must be secured by establishing a new accreditation criteria which specifies that each school must produce its proportionate share of minority graduates by some specified date.

The predominantly Black engineering schools are an essential

ingredient in the national educational structure and to the achievement of the goal of this Symposium. Their expansion and improvement must be secured promptly through broadly-based long-term programs of financial support from government, industry and foundations to significantly increase engineering enrollments on those campuses.

There were the following supporting recommendations, generally directed at predominantly white institutions:

1. Formal programs must be organized and undertaken to raise the sensitivity level of (white) faculty members to the unique problems of minority students. Until and unless this is done a program for minority students should not be undertaken.

2. An extensive supporting program of tutoring must be introduced and pursued aggressively. The leadership of the predominantly Black schools in these areas of remediation and retention through tutoring and counseling should be copied. Students needing help should be sought out, not made to show up at the door. There should be diagnostic testing for weaknesses so that appropriate tutoring efforts can be applied as needed. Entrance deficiencies should be overcome promptly. The tutoring program should involve minority students both in the planning and the execution of the program. The faculty itself must be tutored about special problems of minority students. Self-paced learning facilities such as CAI (Computer Assisted Instruction) and audio and video tapes should be available for those needing individual attention in basic concepts of mathematics, science, laboratory work and in problem-solving.

3. A comprehensive counseling program should be established on a personal and highly individualized basis. It should treat

a) academics, b) personal problems, c) financial problems, d) career objectives, e) campus life, and f) housing both on and off campus, and so on. The counseling program should aim at teaching students principles of self-survival in the engineering curriculum rather than merely coaching them through. The campus reward system for participation in this type of activity on the part of faculty members and administrators should be strengthened, and the program should be operated by minority faculty, administrators and students.

4. Predominantly white universities must make a fundamental commitment to the minority program in engineering, and administrative control must be in the college of engineering with a minority student and faculty committee to monitor the program and advise the dean. It is necessary to improve articulation with high schools, junior colleges, and four-year liberal arts colleges. High school representatives should be brought to campuses to discuss the needs of freshmen in mathematics and science, to provide for early admission of bright students and to identify possible areas of student problems.

5. There must be a feedback to high schools and junior colleges regarding the performances of their graduates. The colleges must work closely with the high schools to improve the instruction in mathematics, which is poor in many cases, and frequently abominable in the case of minority students. There must be more summer articulation programs to bridge the gap between the students' high school preparation and the demands of his first year of engineering at the university.

6. It is necessary for colleges to work intensively with industry to develop a wide spectrum of part-time and short-term employment opportunities for the summer, inner term, Christmas and Easter recesses, and for co-op work periods. These jobs must provide engineering or engineering-related experience as well as motivation for the student. The financial return is essential in meeting a wide range of expenses faced by all students as well as the frequent need for the minority student to contribute to the support of his family.

7. Predominantly white schools, in planning minority programs, must provide meaningful and substantial support for minority student organizations and for efforts to involve minority students in the organizations of the majority students, including student government, professional societies and social groups.

These recommendations were addressed to government and industry:

1. Each government agency and industrial organization should announce and publicize its numerical goals for the acquisition of minority engineers projected approximately five years ahead. The purpose here is to establish the validity of the alleged demand for minority engineers.

2. Employment and financial support plans as outlined earlier for industry must be worked out in cooperation with the universities. For example, students who Co-op may earn 35 to 45 percent of the grants needed to support them in full-time school; or HEW, through the college financial officers, can grant off-campus work-study monies at the rate of 70 to 80 percent payment to public institutions.

3. Efforts should be made to develop close ties between the predominantly Black schools to provide support and opportunities comparable to the favored-son treatment accorded certain predominantly white schools by certain companies and certain government agencies. This could take the form, for example, of long-term contracts for summer employment of students and some sustaining financial support of meaningful magnitude.

4. Finally, the Engineers' Council for Professional Development should introduce accreditation criteria to relate to the institution's commitment to minority education.* For example, the ECPD might require that at a future date, such as 1978, there must be either ten minority graduates per school or five percent of the graduating class, whichever seems most appropriate for that size of school.

PROGRAM FINANCING RECOMMENDATIONS

1. Some form of forcing function, in some cases by the ECPD,* should be provided to insure that predominantly white universities observe the priority of this program. Universities should use matching funds to help increase the number of minority students.

2. Necessary financial resources should be provided for the six traditionally Black engineering institutions so they can increase their enrollments by at least five-fold.

3. Government agencies should take note of the minority engineer shortage and provide funds to alleviate the situation.

* This recommendation provoked considerable controversy, some participants feeling that it was "rather presumptuous of us to tell ECPD that they must do something." The consensus of opinion was that ECPD might examine how its accrediting policies might significantly assist in the enrollment and education of minorities in engineering schools.

4. A national commission should be established to coordinate industry's commitments toward increasing the employment of minority engineers and to insure that equal possibilities of upward mobility do, in fact, exist. Industry also should spell out its goals of employment for minority engineers and provide financial support for engineering schools commensurate with the number of expected graduates.

MORE RECOGNITION FOR SPANISH-SPEAKING MINORITIES

During the final plenary session, a recommendation was proposed from the floor by Pilar Pena, a civil engineer with the U. S. Army Corps of Engineers, who is also a Mexican-American and member of the American Society of Civil Engineers' Committee on Minority Programs.

"I heard some very good recommendations that we support Black engineering schools," Pena said. "Never once did I hear let's establish a Brown engineering school. I think that's ridiculous. Why have two schools, one Black and one white? Why not have one school?"

Accordingly, Pena proposed the following resolution:

1. We recognize that no two-day seminar can cover adequately all the issues of vital importance to our country.

2. The major shortcoming of the conference was the inadequate discussion of the problems of the Spanish-speaking and other minorities, such as the American Indians and Orientals.

3. We recommend therefore that the report of the Symposium emphasize the following:

A. An explicit recognition of the above point.

B. A recommendation that the special problems relating to the Spanish-speaking, Orientals and Native Americans such as the poor from Appalachia, be the subject of a future conference.

C. That the follow-up of Symposium recommendations be the responsibility of a committee composed of an adequate number of representatives from the Puerto Rican and Mexican American communities. This committee should include representatives from ethnic community agencies.

4. That the Academy contact and work closely with Spanish-speaking community agencies such as ASPIRA and LULAC. These agencies should be involved in the planning and execution of future conferences.

The resolution, as read from the floor was adopted unanimously. Chairman Marshall commented that the Symposium was dealing with a complex social problem, not a technical one, "... and when we get into that area we're really working a little bit in the dark." He said, "There are imperfections, and I think the problem we face is learning to live with the imperfections and remove them. The next time we have a Symposium of this kind we presumably will know how to proceed with a sharper focus and more time for planning."

A. E. Greaux, Dean of the School of Engineering, Prairie View Agricultural and Mechanical College of Texas, noted that he was chairman of the Engineering Deans of the six traditionally Black engineering institutions. "The Council of Deans of the six Black schools of engineering endorses the basic goal of this Symposium which will significantly increase minorities in engineering," he stated. "It commends the National Academy of Engineering for its initiative in calling this Symposium and looks forward to mutual reinforcement. The Council offers its experience as a major resource in formulating and marshaling new and expanded approaches to increasing the successful production of minority engineers."

This summary has been prepared from the tape recording made during the Plenary Session of the Symposium on Increasing Minority

Participation in Engineering, and the notes of workshop and topic chairmen. It has been reviewed by those who were most intimately involved in the conduct of the Symposium to insure that it reflects as accurately as possible, the spirit and will of the participants.

During the Plenary Session it was suggested that many schools, industries, professional societies and other groups might like to contribute a short description of their present and planned programs focused on minority students to these Proceedings. Appendix III is a compilation of those that were received.

W. Robert Marshall, Chairman
Commission on Education

September 1973

DEAN JOHN TRUXAL: A WRAP-UP COMMENTARY

I think this is a signal event for the National Academy of Engineering to hold a meeting of this nature, but I am concerned that we are meeting here in a high degree of emotion and enthusiasm and will go away and not very much will happen. I think we should remember as we leave, however, that we have benefitted. We have established some communication channels, we have learned that a tremendous amount is going on at the present time around the country and in various institutions. I think I have a better understanding of what can be done, and of what some of the problems are that we're going to face.

There are several forces acting on this model of engineering education we've been considering. We've seen the concern of industrial organizations, we've seen a trickle of minority graduates into engineering, we've seen engineering schools very worried about their low enrollment. We've seen the low public opinion of engineering as a profession and a career reflected in the comments of guidance people, high school teachers, members of the general public, both minority and majority. But it seems to me from listening to the last two days, three specific needs emerge. I hope that in our charge to industry and in our charge to the National Academy of Engineering, particularly the latter, we will in our report of this Symposium emphasize the importance of these three needs.

The first is a vastly improved model of the system that we're trying to work with here. We heard lots of data, but it was all of a rather gross nature. In my own control engineering terms, we heard input, output or transfer function data, but we never did get

into the state model of the system.

We heard that the decision against engineering is made in the junior high school, but we never heard why or when or how that decision is affected by middle school concepts; how it's affected by the quality of science instruction in the junior high school. We need to consider also the elementary and secondary school educational problems. We heard that the percentage of Blacks going into engineering was about the same as the percentage of whites, but we didn't hear about the percentage taking science in the high school and how this related to family economic status, etc. What emerged from our two days' discussion is that we have both a short-term and a long-term problem.

Most of our discussion has been about the long-term problem. How, in ten years, we're going to move toward a ten-fold increase in minority students entering in the freshman year.

I think we also have a very significant short-term problem. In feedback control engineering, if you want to do something immediately without being concerned with the time lags of the system, you use feed forward. We need to do the same thing with this particular problem. We need to feed some of the graduates from minority groups in other areas into engineering by shortcutting the usual eight years of engineering education from the freshman year of high school on the graduating baccalaureate. We've got to look at our engineering educational program and find out how we can feed people in at various points along the way.

What are the attitudinal and behavioral objectives we really want out of engineering education to qualify people to contribute

in industry and how can we attract people in, in that way? So in order to do the feed forward operation, in order to make a change in less than a decade or two decades, in order to make a change on a reasonable time scale, we have to know in detail what the characteristics of the system might be.

The second major need certainly is for trained and experienced manpower on the problems we're talking about. We need a large number of qualified people who can participate in the long-term effort to change public attitudes toward engineering of both the minority and majority members of the population. We need people who can cooperate with industry and government in developing new educational programs, who can impedance match the programs we have to the incoming students, whatever the level may be.

Finally, the resolutions you have before you epitomize this. We really are demanding a national mobilization of our mutual efforts to be sure something happens. We're really asking the National Academy of Engineering to do something, to bring pressure on ECPD, for example, to simply say in very blunt terms: We will not accredit engineering schools after 1978 unless they have a proportion of minority engineering students that is commensurate with the population area from where their students are drawn.

We're saying we must push people, we must act. We must look to the National Science Foundation through the Academy of Engineering to emphasize innovative educational and research programs which aid our goals in this particular objective we have laid out for ourselves. And we must ask industry to bring pressure on the universities and one another to accomplish this same thing.

I think that we must have a positive program to come out of this Symposium when we go home tonight. We should be able to say to ourselves we have adopted motion toward specific activities. By 1976 or 1978, or some time at least within the lifetime of most of us in the academic-industrial world, we will indeed see some progress. I think this is the message that I gained from the impatience of people over the last two days as we listened to them talk.

Let's get on with some action, let's move forward, let's get the National Academy of Engineering, the industrial community, and the academic community, and government to truly join hands and take some positive action in this long overdue area.

A COMMENT BY CHAIRMAN MARSHALL

In reply to Dean Truxal's statement, Chairman Marshall pledged, as a member of the NAE Commission on Education, that "...the recommendations adopted by this Symposium will not lie on the desk collecting dust. The Commission will proceed to carry forth with the directions that have been placed before it. This is a challenge, and we like challenges. We think we have some exciting ones here. So be assured that we are not going to just leave here with nothing down the road. You will hear from us, you will hear from us many times again."

Appendix I

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Appendix II

SYMPOSIUM PAPERS

Increasing Minority Participation in Engineering

Commission on Education
National Academy of Engineering
May 6-8, 1973

1. *WHY MORE MINORITIES IN ENGINEERING NOW?*

   Staff document

2. *A COST ANALYSIS: Schools with Predominantly Minority Enrollment*
   Dr. Reginald Amory, P. E.
   Dean, School of Engineering
   North Carolina A & T State University

3. *ENGINEERING SCHOOLS, INDUSTRY AND MINORITY RECRUITMENT: A Search for the Impedance Problems*
   Gordon L. Berry, Ed. D.
   Assistant Dean, Graduate School of Education
   University of California, Los Angeles

4. *COOPERATIVE EDUCATION AT THE PREDOMINANTLY BLACK ENGINEERING SCHOOLS*
   W. J. Carter
   Dean, School of Engineering
   Tennessee State University

5. *$312,000,000--THE COST OF A DECADE OF COMMITMENT: The Cost/Benefit of Significantly Increasing the Enrollment of Minority Engineering Students in Predominantly White Engineering Colleges in the U. S.*
   Donald G. Dickason
   Director, Engineering Admissions
   College of Engineering
   Cornell University

6. *P R E F A C E -- A PILOT PROGRAM OF EDUCATION IN SCIENCE AND ENGINEERING FOR MINORITIES AND WOMEN.*
   W. W. Grigorieff
   Educational Consultant to the Atomic Energy Commission
   and Assistant Dean, Graduate Studies
   University of Arkansas

7. *A MANDATORY CHALLENGE TO PREDOMINANTLY WHITE COLLEGES OF ENGINEERING: Increase the Output of Minority Engineers.*
   Willie James Nunnery, Director
   Assistant to the Dean
   Minority Engineering Program
   University of Wisconsin

8. *THE CONSORTIUM APPROACH: THE DELAWARE PROGRAM FOR BLACK ENGINEERS.*
   Rodney Reeves
   Acting Program Coordinator
   Delaware Program for Black Engineers

9. *A STUDENT INITIATED MINORITY ENGINEERING PROGRAM: The University of Kansas.*
   James M. Rosser
   Associate Vice Chancellor of Academic Affairs
   University of Kansas

THE DUAL DEGREE PROGRAM AT THE GEORGIA INSTITUTE OF TECHNOLOGY
F. W. Schutz, Jr.
Dual Degree Coordinator
Georgia Institute of Technology
Atlanta, Georgia

11. *IDENTIFICATION AND LOCATION OF MINORITIES FOR ENGINEERING*
    Calvin H. Conliffe
    General Electric Company
    Bridgeport, Connecticut

12. *MINORITY STUDENTS IN ENGINEERING SCHOOLS: SCHOOL WITH PREDOMINANTLY MINORITY ENROLLMENT*
    M. Q. Burrell
    Dean
    College of Engineering
    Southern University
    Baton Rouge, Louisiana

13. *PRIVATE SECTOR SUPPORT FOR MINORITY ENGINEERING PROGRAMS*
    David G. Moore
    Senior Vice President for Research
    The Conference Board

A limited quantity of the above papers
are available at no charge from:

National Academy of Engineering
Commission on Education - JH611
2101 Constitution Avenue, N. W.
Washington, D. C. 20418

Appendix III

COLLEGE OF ENGINEERING
THE UNIVERSITY OF BRIDGEPORT
Bridgeport, Connecticut

EDY PROGRAM
(Engineering for Disadvantaged Youth)

The EDY Program in the College of Engineering of the University of Bridgeport is in the process of starting its third year. Its express purpose is to seek out minority students in the greater Bridgeport area, inspire them to give engineering a try, provide enrichment (remediation), and through this, matriculate them into the College of Engineering. Then, with deep-rooted dedication, to provide on-demand tutoring with appropriate intervals of TLC (Tender Loving Care), and to help motivate the student to attend classes regularly and on a competitive scholastic basis to fulfill the rigorous requirements of an engineering education.

We "seek" students by going directly to the high schools and talking not only with principals and advisors but also with chairmen and teachers in the mathematics and science departments, requesting the names of minority students who have had, preferably, three years or more of college-preparatory mathematics. Through personal interviews and detailed explanation to the prospective student and parent, we inspire the candidate to give serious consideration to engineering as a life's work.

The enrichment process is of seven weeks duration, four hours a day, five days a week, through the months of July and August. During this time, the student is given remediation in reading and comprehension, mathematics, and physics, as well as computers, from desk type to large complex ones using BASIC language. All those completing the program successfully are given an official certificate attesting to their accomplishment. The complete cost of the summer remediation is borne by the program. While at present no funds are available for housing, it is our intention in the future to make this available to at least 50% of the students. We will further increase the length of the summer program to be of eight weeks duration, six hours a day, five days a week.

During this entire interval, tutoring is available on demand and the student is encouraged to take advantage of it. It should be noted that every effort is made to place the student who completes the summer program either on this campus or into some other institution or job commensurate with the student's accomplishments and desires.

The student who matriculates, does so with his complete tuition and fees covered by this program for the freshman year. In each instance, the officers and tutors in the program pay particular attention to the student on a daily basis, with weekly meetings of the entire group a must. Again, through careful tutoring, it has been possible for us to take students with average combined SAT scores of 650 and motivate them sufficiently to end up with Q.P.R.'s in excess of 3.0, on a 4.0 scale.

After the freshman year is completed, the student moves along into the Cooperative Education (work-study) phase of his education, which enables him to earn sufficient money to pay for his tuition, books, and some other incidentals. If the student performs properly, at the end of five years he ends up with a degree in a specific area of engineering, or a B.S. in a related field, such as Biomedical Engineering. Thus, a degree and the equivalent of one calendar year of work experience at an approximate starting salary of $9-10,000 is his reward, let alone the fact that he is a member of a challenging profession.

LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA
Berkeley, California

M.E.S.A.
(MATHEMATICS, ENGINEERING, SCIENCE ACHIEVEMENT PROGRAM)

For the past four years the Math, Engineering, Science Achievement Program (MESA) has worked with high school students of minority background in a special effort to develop engineers and scientists.

Many high school youth of minority background have stated goals of becoming an engineer or a scientist but few have realized this wish. It is the goal of the MESA program to find promising young people in the 9th, 10th, 11th and 12th grades; young people who state they want to pursue engineering or science in college. Promise is measured in terms of a student's enrollment in a full college preparatory course of study, his performance in mathematics and a teacher's assessment.

The MESA program is designed to give academic support to the student participants, to create an awareness on the part of the student towards the fields of science and engineering, and to encourage and reward academic achievement.

The program offers academic tutoring at the high school. This tutoring is given by adults who are working in technical fields. In addition, appointments are made for students to meet with engineers and scientists at their place of work. Counseling for applying to college as well as individual counseling are conducted on a special basis. One of the primary goals of the program is to give as much recognition and support as possible to each student.

Students participate in field trips to colleges and corporations where technical and scientific projects are undertaken. These trips are conducted on a monthly basis. Efforts are now being made to arrange for summer jobs for students with the various corporations that the students identify with.

In accordance with research that correlated immediate recognition with performance, the Program rewards student academic achievement with scholarships. For those students who maintain a "B" average in college preparatory subjects, the Program gives a scholarship of $50 a month.

In the case of some students, the scholarship eliminates the need for after school jobs. The scholarships are given on a monthly basis by the mathematics teacher and much importance is attached to this presentation.

The MESA Program is sponsored by the Lawrence Hall of Science at the University of California in Berkeley. It was started by a group

of eleven citizens, black and white, who raised an initial $10,000 and who act as the Advisory Board for the Program. University students are working part-time as coordinators; other persons associated with the Program have volunteered their time.

Over twenty students have graduated from the program and are now in college. From reports by the students, their performance in college is strong.

INSTITUTE OF TECHNOLOGY
CARNEGIE MELLON UNIVERSITY
Pittsburgh, Pennsylvania

C-MAP

Carnegie Mellon Action Project (C-MAP) graduated its first class in May, 1971 and is now in its sixth year of operation. C-MAP is defined by its director, Professor Norman Johnson, as an experiment which is "the primary vehicle for bypassed Americans into Carnegie Mellon University."

Candidates for admission are selected primarily on the basis of personal interviews, recommendations and other individual evidence of potential and motivation. Standard "predictors of Performance" such as SAT seem to have a low predictability for blacks, it was reported in the 1971-72 Annual Report of the Project. The report also notes that "The Black experience for Black males particularly, gives them a fair amount of skill in the matter of management. C-MAP teaches a black male how to utilize this skill, giving him a comparative advantage in the acquisition of knowledge."

Students receive full tuition scholarship grants during their freshman year. During the next three years, they are required to pay a portion of the college's costs. Loans and summer jobs are made available to assist students.

Entering C-MAP freshmen participate in a summer program, "Pace and Go", which reviews high school courses in order to overcome academic weak points. Programs providing orientation, counseling, tutoring and special learning classes are available to all C-MAP students, who are nevertheless still expected to complete the same academic program as other students.

The program attempts to conserve the student's energies by controlling or limiting social space, according to its director, by decreasing the energy output in non-academic settings. This control is facilitated through additional regulations placed on C-MAP students such as the requirement that all Black students live on campus until their senior year.

SCHOOL OF ENGINEERING
CASE WESTERN RESERVE UNIVERSITY
Cleveland, Ohio

BLACK ENGINEERING OPPORTUNITIES PROGRAM

A new program has been launched to increase dramatically the number of talented minority students preparing for an engineering career at Case Western Reserve University. The unique features of the plan include a modified cooperative education approach with industry, a continuing grant-in-aid to the students, special academic work at Case before the students enroll, and special course sections and counseling.

The purpose of the approach taken in this program is to maximize motivation, maximize the possibilities of academic success, and guarantee financial support for the student.

In brief, each industry participant will sponsor one or two new students each year (4 or 8 students in steady state). The company will provide for each student:

1. A meaningful engineering job starting with the prefreshman summer and continuing through each succeeding January intersession and summer so long as the student remains in good academic standing and is satisfactorily progressing in his engineering program.

2. A $1,000 grant-in-aid during each of the first two years.

3. A $2,000 grant-in-aid for each of the last two years and, if necessary, an additional semester or year if needed for the student to complete his B.S. degree. This aid may be in exchange for student involvement in a company sponsored project pursued for course credit, as is presently done in some project laboratories.

Note that the grants-in-aid involve a company commitment of $12,000 a year under steady state (two new students a year), or $6,000 for a program with one student per year.

The commitment of the University to this program is to:

1. Arrange the remainder of the funding required by the student taking into account the financial position of his family.

2. Provide extra academic preparation to make up for insufficient background in Sciences, Mathematics, and English.

3. Recruit and counsel students in a very intensive manner to insure that we get outstanding students and to maximize the likelihood that students will successfully complete their programs of study.

4. Recommend students whose interests match the needs of the sponsoring companies, and arrange transfers within the program if a student's interests change.

The program is equally applicable to students transferring from a community or junior college to the CWRU engineering school. The work experience, the company advising and counsel, the extra preparatory study, the project opportunities will all be designed to develop motivation, practical engineering know-how, skills of many kinds and an ideal educational program.

COLLEGE OF ENGINEERING
UNIVERSITY OF DELAWARE
Newark, Delaware

DELAWARE PROGRAM FOR BLACK ENGINEERS

For several years one or more blacks have been enrolled as undergraduates in the College of Engineering. Efforts were made to recruit black graduate students but with very limited success. An October 1971 regional conference at Drexel University on the recruitment of minority students provided sufficient insight to enable the College to make a new start and to achieve some success.

The need to have black faculty and graduate students as resource persons and to provide financial support was recognized. Support was sought and obtained from local industry, especially the Du Pont Company. Cooperative arrangements with Delaware State College and the Delaware Technical and Community College were established.

In September 1973 we anticipate having a distinguished visiting professor, a doctoral student, three capable master of science students and approximately fourteen full-time undergraduates ranging from freshmen through senior year. In addition, several pre-engineering students will be enrolled at each of the cooperating institutions.

Local industry has provided both summer employment and financial support. The academic performance of the students is encouraging, and a spirit of enthusiasm prevails.

ATLANTA UNIVERSITY CENTER COLLEGES
and the
GEORGIA INSTITUTE OF TECHNOLOGY
Atlanta, Georgia

THE DUAL DEGREE PROGRAM

The Dual Degree Program joins the resources of two Atlanta educational complexes--the Atlanta University Center, the largest cluster of private colleges in the United States with a predominantly Black enrollment and the Georgia Institute of Technology--a state university with the largest undergraduate engineering enrollment in the United States. Under this program, students attend one of the four undergraduate colleges in the Atlanta University Center for three years and then transfer to Georgia Tech for an additional two years. Upon successfully completing the program at both institutions, the student will simultaneously receive two degrees--a Bachelor of Arts or Science degree awarded by the affiliated Atlanta University Center college attended and a Bachelor of Engineering Degree from Georgia Tech. In cases where career ambitions and the student's abilities suggest the second degree may be at the Master's level at Tech or at the Bachelor of Engineering Technology level awarded by the Southern Technical Institute, a division of the Engineering College at Georgia Tech.

The Program began its fourth year in September 1972, with a total enrollment of 164 students. Fifty seven percent of these students come from outside the state of Georgia. The projected enrollment for 1975-76 is 400 students. These projections are realistically based on recruiting experiences with students from all over the country. Not only has the program been successful in recruiting a rather large number of engineering students, it also has attracted students who are, on the average, better qualified than the typical Atlanta University Center student.

During the Winter 1973, there will be 10 full-time Dual Degree Students studying at Tech with 5 others taking courses at both Tech and their A.U.C. college. The first graduates will be completing their engineering degrees in the spring and summer of 1974. Two of the first 10 are candidates for the Master of Science in Engineering degree.

The initial financial support for this Dual Degree Program in Engineering came in the form of a substantial grant of $265,000 from the Olin Charitable Trust Fund. These funds were expended over the first three years. In the meantime a much wider base of support has developed. The opportunities for growth are so great that additional financial support is a real need. Many firms and agencies are also supporting the students on this program through meaningful summer employment.

The Dual Degree Program is an outgrowth of a plan of study initiated at Georgia Institute of Technology in 1954 called the Three-Two Plan in Engineering. That year, Tech joined five colleges in offering students the opportunity of coming to Tech to get baccalaureate degrees in engineering only along with the liberal arts degree from their original colleges.

The Dual Degree Program can serve a real educational need and seems to be a positive step in the Institute's efforts to expand its offerings and render greater service to the state and the nation. It offers to the student a means of obtaining a very broad education by attending two colleges with distinctly different educational emphases--one, liberal arts and the other, science and engineering. It enables some students to vary their college experiences in other ways: by studying at two colleges of different size; by studying at a church-related college and a public (state) college; by living in a large city while attending one college and a smaller community while attending another; by living away from home for part of the college experience and residing at home for the other part. For some students the Plan offers a realistic means of meeting the demanding academic requirements of a technological university after having been denied proper high school preparation.

CULLEN COLLEGE OF ENGINEERING
UNIVERSITY OF HOUSTON
Houston, Texas

COOPERATIVE EDUCATION CAREER COUNSELING PROPOSAL

I. ADMISSION
- A. Identify disadvantaged minority students from high schools or Community Colleges.
- B. Have them admitted under a project block admissions request.
- C. Place these students in Co-op jobs for their first semester.

II. COLLEGE ACTIVITIES
- A. First semester
  1. While working as a Co-op, these students would come to campus for a battery of exams to identify their academic, social and operational needs.
  2. During this same semester, counselors and tutors would meet with these students to begin work on their weaknesses.
  3. These same counselors would be available for students' needs in working, financial and social areas as the students and counselors identified these needs.
- B. Second semester
  1. The same counselors would advise along with faculty members for the students' classes.
  2. The same counselors would counsel with regards to campus, academic and other student needs.
  3. Tutors would be provided for working on the students' needs.
- C. Third semester
  1. Student returns to work.
  2. Same counseling positions are available to meet the students' needs.
- D. Subsequent semesters
  1. This same semester sequencing would be carried on until the Senior year.

III. PURPOSES, NEEDS, ESTIMATED RESULTS
- A. Pro's
  1. Most minority students need financial aid: Co-op provides this prior to classes.
  2. Need for career identification: Co-op provides this.
  3. Need to develop different personal work, academic, and social types of operations. The counseling operation attempts to provide an individual or small group provision for these needs.
  4. Need for career and academic identification and motivation--CECCP provides both of these.

5. Need for self-identification on campus. Small size and intimate counseling group should provide for this.
6. Provides for remedial academic work outside classes.

B. Con's
1. Cost of counselors and tutors.
2. Additional time needed for college.
3. Extra time needed for tutoring and counseling.

COLLEGE OF ENGINEERING
UNIVERSITY OF ILLINOIS AT CHICAGO CIRCLE
Chicago, Illinois

LEARNING CENTER FOR MINORITY GROUP STUDENTS IN ENGINEERING

Since its inception in 1965, the University of Illinois at Chicago Circle has had an Educational Assistance Program - campus wide - whose functions include home and high school liaison, financial aid assistance, special remedial course offerings, and arrangement of special entrance requirement waivers. Although the E.A.P. was fairly successful in attracting minority group students to the campus, it was fairly unsuccessful - until recently - in attracting engineering students.

Approximately three years ago an Assistant to the Dean for Minority Group Students, a black graduate of UICC, was appointed in the College on a 50%-50% basis with E.A.P. Shortly thereafter, virtually every minority group student in the College (numbering about 40 out of an undergraduate population of about 2000) joined a newly-formed Association of Minority Group Students. With the help of the Assistant to the Dean and the College Staff, this student group conceived and presented to the College Administration a plan for the institution of a Learning Center to be situated in the College's laboratory complex. The plan was accepted immediately and the Center went into operation. In addition to laboratory space, the College provided impetus for the Center through the furnishing of funds for student tutors' wages, providing teaching assistants' time for the Center, and the furnishing of supplies, books, equipment, etc. One of the strong reasons for starting the Center was the recognition by everyone concerned that recruitment of minority students into engineering depends heavily on the availability of special facilities and resources in the College.

One interesting aspect of the Center is the student-generated "self-help" feature. Students at the advanced undergraduate level act as tutors for students in their beginning years. Also, students "pay" for their tutoring by helping to recruit others in minority-populated high schools.

Thus far, the Center has been successful. The minority group student population has gone from about 50 to about 200 in the last two years. The grades of students who have made use of the Center have improved, and their retention rate in the College is higher.

SCHOOL OF ENGINEERING
UNIVERSITY OF KANSAS
Lawrence, Kansas

SCoRMEBE
(Student Council for Recruiting, Motivating and Educating Black Engineers)

SCoRMEBE is a student-controlled organization with basic responsibility for the livelihood of the minority engineering program at K.U. and during the 1970-71 school year gained official recognition as a student organization. Staff support has increased during the past 2 1/2 years; nevertheless, program participants (members of the parent organization) are still primarily responsible for fund-raising, recruitment of students and program staff, liaison with faculty and administrators, and the planning, implementation and evaluation of program activities.

1. Unlike many minority student programs at predominantly white universities, SCoRMEBE students are not under the administrative auspices of a "general" university program, e.g., Minority Affairs, Affirmative Action, Black Studies. The program, including financial aid, academic advisement, tutorial and study-skill development activities, is grounded in the School of Engineering.

Students are accepted into the program on the basis of interest in engineering, recommendations from high school counselors and teachers, and grade point average, with major consideration given to the student's interest in engineering.

Significant efforts have been undertaken to expand program services to include Spanish Surnamed and Native Americans. In addition to visiting high schools and Indian reservations, program staff have consulted with Spanish Surnamed students through the Department of Minority Affairs at Wichita State University. Haskell Indian Junior College, which is located in Lawrence, represents a significant source of Native Americans.

The SCoRMEBE program has been divided into two parts: (1) the SCoRMEBE Summer Program; and (2) the regular academic year program. Both programs have a director, support staff, and two faculty advisors. In both programs, it has been the responsibility of the director to solicit funds from interested industrial corporations, recruit students for summer and fall activities, and generally oversee the day-to-day operation of the program.

In general, special services are provided in both programs which are designed to facilitate successful adjustment to a major university environment and to aid in the alleviation of problems attendant to: (1) poor high school preparation in math and the basic sciences; (2) low verbal skills - reading, writing, oral presentation; (3) poor mechanical skills - graphics, computation; and (4) poor study habits.

During the summer, special courses are offered in slide rule and computer programming. Students also enroll in math and basic science courses offered as a regular part of the University's summer program. Individual programs are worked out for each student, i.e.,

the academic status of students is decided through a special arrangement with department chairmen. Students in SCoRMEBE audit the classes of their choice, but are expected to participate in each class by asking questions, doing all homework assignments and by taking all exams, including finals. At the end of a course, students may elect to receive credit for the course. If a student elects not to take credit, there will be no record of the course on the student's transcript. If a high school student has college credits before graduating, there is a great sense of accomplishment, and this, in turn, has to be a great motivating factor.

Special housing arrangements and tutors and counselors have proven important to successful adjustment. Correlatively, because of a general understanding of the role of the engineer as a member of a highly technological society is important - with due emphasis on the minority engineer - several special seminars are held in which industrial and University personnel make presentations relative to engineering careers. Career counseling has been augmented by the special seminars and informal meetings. Seminars, social functions, and informal meetings are integral to the summer and academic year programs. For example, the 1972 summer program terminated with an awards dinner for participants and their families.

During the regular academic year, special advisement, counseling, and tutoring services are provided as needed and all students are encouraged to participate in SCoRMEBE activities. Individual financial awards are based primarily on established need during the regular academic year. A cooperative summer job placement program has provided practical experiences and financial flexibility for matriculating SCoRMEBE students.

SCHOOL OF ENGINEERING
UNIVERSITY OF MASSACHUSETTS
Amherst, Massachusetts

ENGINEERING CAREER ORIENTATION FOR MINORITY HIGH SCHOOL STUDENTS

The Engineering Career Orientation (ECO) program at the University of Massachusetts is a joint endeavor of the School of Engineering and The Black Scientist Society on our campus and was initiated in Fall 1971.

The ECO program is designed to identify, motivate, and prepare minority high school students for an engineering education at the University. The program consists in part of periodically bringing high school students to the University for seminars, laboratory demonstrations, workshops, and field trips to local industries. The intent here is to motivate and familiarize the students with the field of engineering and the varied opportunities available with a college degree in engineering.

In addition, the ECO program consists of a 3-4 week summer phase in which a small group of students is invited to live on campus while participating in project oriented engineering activities. In sum, the ECO program attempts to interest students in engineering early in their high school career under the assumption that if a student is motivated, he will be able to take advantage of the science and mathematics courses available in his high school and, thereby, be prepared for entrance into an engineering curriculum.

COLLEGE OF ENGINEERING
THE UNIVERSITY OF MICHIGAN
Ann Arbor, Michigan

MINORITY OPPORTUNITY PROGRAM

The University of Michigan started its Opportunity Program in 1963 to recruit and to assist students--particularly those from minority groups--who had not had the advantages of other University of Michigan students but who could--with help--make it. In 1970, the University's Regents approved a goal of "ten percent enrollment of black students and substantially increased numbers of other minority and disadvantaged groups" by 1973-74. At that time, the Opportunity Program and other minority student services was substantially increased in size and scope. In particular, financial aid was pledged so that no minority student need discontinue his education for lack of funds to pay tuition, books, room and board.

The College of Engineering realized that an even greater effort was needed in engineering. In 1970, it established a Minority Projects Office to offer services directed specifically to minority engineering students to supplement University wide efforts. Today, a full time staff of three, aided by part-time tutors and counselors, coordinates an effort in recruiting, admissions, financial aid, tutoring, counseling and job placement.

Since 1970, the number of minority students enrolled and the number of minority graduates of the College of Engineering has more than doubled, and the number continues to grow.

COLLEGE OF ENGINEERING
MICHIGAN STATE UNIVERSITY
Lansing, Michigan

ENGINEERING EQUAL OPPORTUNITY PROGRAM

The Engineering Equal Opportunity Program has been in operation for the past five years. Its objective has been to increase the enrollment and the retention of minority (mainly black) students in the College of Engineering at Michigan State University. From the very beginning the Engineering Equal Opportunity Program has been experimental in nature and flexibility has been maintained in order to meet the variety of needs of our students.

Since the inception of the program the number of minority students enrolled in the program has grown from less than ten in 1968-69 to eighty-two during 1972-73; more importantly, the number of graduates has expanded from one in 1969 to where we anticipate twelve graduates by summer, 1973.

The Tutorial Assistance Program provides academic assistance in mathematics, chemistry, physics and computer science. Junior and senior minority group students are paid to serve as tutors for freshmen and sophomore students. Special attention is given to study skills, close contact with students through frequent interaction, and feedback of academic progress in courses.

On-Campus Engineering Jobs. Minority engineering students, in addition to the tutors, are employed as laboratory and research assistants, programmers and departmental aides, to enable students to become familiar with a variety of meaningful work experiences.

The Seminar Series provides opportunities for minority students to interact on an informal basis with leading black engineers and educators from throughout the country.

Visitation Trips. A ten minute slide-tape presentation prepared by minority students provides the introduction for students to talk with junior and senior high students about the opportunities for minorities in engineering.

Academic Advising and Counseling. A black academic adviser and counselor employed by the College assists minority engineering students with academic, personal and social concerns.

Black Students of Engineering is a student group that works cooperatively with the Engineering Equal Opportunity Committee in the development and implementation of many of the special programs. The seminar series, the school visitation activity, and the tutorial assistance program are developed and implemented by this student group.

NEWARK COLLEGE OF ENGINEERING
Newark, New Jersey

ENGINEERING OPPORTUNITY PROGRAM

The Engineering Opportunity Program was initiated in 1968 with twenty (20) black students, all graduates of the Newark high school system. The program has grown to a present enrollment of 150 students comprising 85% black, 10% hispanic, and 5% white and oriental. The program is administered by two black and one Puerto Rican administrators. It is funded through a New Jersey state grant and supplementary industrial and foundation support.

The program's components and services include:

1. Eight week summer preparatory program prior to Freshman year which includes instruction in Physics, Mathematics, Chemistry, English, and Math, college orientation, selective group guidance activities, field trips, and study skills.

2. Financial Aid (State and Federal support)

3. Tutorial activities (Voluntary and mandatory)

4. Counseling activities (Group and individual)

5. Student activities (Cultural events, etc.)

6. Problem solving seminars

7. Community advisory board

8. Recruitment and admission activities

9. Evaluation and feedback procedures

10. Job placement

All are educationally and economically disadvantaged. Their elementary and secondary preparation is initially inadequate for regular admissions without supportive services and their family income is less than $10,000.

In spite of their initial disadvantage, the overwhelming majority has succeeded academically and personally.

SCHOOL OF ENGINEERING
NORTH CAROLINA STATE UNIVERSITY
Raleigh

ENGINEERING PROGRAM FOR BLACK STUDENTS

North Carolina State University's School of Engineering has invited black high school students to attend a one-week session on the campus during the summer after the eleventh grade. Two sessions are planned for 1973: one for June 11-15; the other for June 18-22. Contacts were established with high school counselors in schools with large black enrollments and through them information and application blanks were distributed. The response exceeded our expectations. We had planned for 30 in each of the two sessions, but had applications from more than 120 students. Some of these were apparently not college material and were deleted. Sixty-seven students have been invited, 33 for one term and 34 for the other. Sixteen of these are women.

The program will begin at noon on Monday and will involve sample classes, tours of laboratories, visits to departments, sessions with admissions and financial aid personnel and two field trips. The field trips will show black professional personnel and engineers in action. Students will live in the dormitories and eat in the University Center. Black NCSU students, three for one session and two for the other, will also live in the dormitories and be with the students as guides and hosts for after-hours activities.

Money to cover the out-of-pocket costs (about $35 per student) for room and meals and student aides was solicited from industry. The appeal was made to North Carolina industry to finance a North Carolina school in its efforts to increase the enrollment of North Carolina blacks. Personnel costs of the director of the program and other faculty time were absorbed by the School of Engineering.

Although this write-up precedes the program, we believe we have hit on a good pattern. Students will return to their schools for another year of study. We will have an opportunity to follow-up with them during their final year of study and they in turn may help to spread the word to others among their friends.

COLLEGE OF ENGINEERING
THE OHIO STATE UNIVERSITY
Columbus, Ohio

AFFIRMATIVE ACTION AWARD PROGRAM

The College of Engineering at the Ohio State University has long sought to enhance its enrollment of minority students. In January of 1972, the College strengthened its minority recruitment program by initiating an Affirmative Action Award program. The program is intended to assist all minority students; however, due to the distribution of the minority population in Ohio, greatest emphasis has been directed to the U.S. black high school student.

Initial funding for the program was provided by the Ohio State University Engineering Experiment Station. Subsequent aid has been received from various members of the industrial and government communities who have seen the merit and potential strength of the program.

In order to be considered for a financial award under the program, the minority high school student must satisfy the following criteria: 1) To have attained a high level of scholastic performance in the mathematics and physical sciences and 2) To possess a strong desire to pursue an engineering career. In order to locate students of this caliber, the College utilizes the following sources of information:

Recommendations from high school counselors, and mathematics and physics teachers.

Recommendations from interested, and distinguished black alumni.

National Merit Scholarship Corporation's list of participants in the National Achievement Scholarship Program for Outstanding Negro Students.

Student profiles furnished by the Engineers' Council for Professional Development.

In addition, the College plans to employ the talents of the members of the Black Undergraduate Engineering Council, a recent university chartered organization in the College of Engineering. This group will aid in our direct recruitment efforts in the several local area high schools.

Some of the main features of our Affirmative Action Award Program are:

Affirmative Action awards in the form of paid tuition and incidental fees for the freshman year. These amount to about $800 per school

year for Ohio students. Awards for the sophomore year depend upon academic performance during the first year. These awards are independent of financial need.

If the student requires further financial aid, it is available from regular university scholarship and financial aid sources.

Special counseling and individual tutoring is available if required during the academic year.

A Pre-Freshman and Cooperative Education for Minorities in Engineering (PREFACE):

1. Pre-freshman employment in jobs related to engineering.

2. Pre-freshman counseling and tutoring to aid in the transition from high school to college.

3. Summer employment in jobs related to engineering following the first, second, and third years of college.

SCHOOL OF ENGINEERING AND SCIENCE
PRATT INSTITUTE
Brooklyn, New York

ENGINEERING EDUCATION FOR MINORITY ENGINEERING CANDIDATES

We, at Pratt Institute, have taken a bold, all-out action to increase the supply of minority engineering graduates by designing a pilot program sponsored by the A. P. Sloan Foundation. We propose to meet this problem in several ways. A major part of our plan to accomplish this goal is the continuation and expansion of our revolving fund, the Repayment Educational Assistance Program (REAP), which covers tuition and fees and expenses for entering minority engineering and science students in Co-op and Tec/Sec programs. Pratt Institute will award 60% of the loan free as a grant. The remainder of the scholarship will be repaid through a reasonable schedule when the student enters the working portion of his Co-op program.

The first priority at Pratt is to recruit and develop minority group students who are prepared. This effort is being done by recruiting at junior and community colleges in the metropolitan area for engineering candidates who have completed a two year program at a technical institute with an A.A.S. degree in Engineering Technology. This will aid in the development of minority engineers in the country, and provide industry with qualified minority engineers in two years from the time they transfer into Pratt as juniors.

The second priority is to establish a pre-cooperative education program wherein interested high school sophomores, juniors, and seniors and high school drop-outs who have attended a college adapter program for the GED from minority groups will be brought on campus for pre-engineering and pre-science education. Pratt accepts students from the General Educational Development program who have equivalency diplomas and have a score ranging from 269-310 (which is equivalent to a score range of 73-83 on a 100 point scale). Students will be provided with summer employment opportunities in engineering firms in order that they become familiar with various engineering fields, and adjust to practical working conditions. They are able to earn enough to meet personal needs during the summer.

In a three-year pilot program Pratt is currently receiving assistance of $180,000 from the Alfred P. Sloan Foundation to alleviate the financial problems for minority engineering candidates. Our present enrollment is as follows:

A. 25 Seniors - 10 of which are veterans who transferred into Pratt as juniors with A.A.S. degrees from community colleges in the metropolitan area.

B. 50 Juniors - 2 females (1 minority E.E. and 1 non-minority M.E.)

C. 50 Sophomores - 2 females (I.E.)

D. 25 Freshmen - 7 females (2 I.E. and 5 Chem. Eng.)

All of these students are receiving some financial assistance from the Sloan grant in varying amounts. Eighteen of the freshmen and eighteen transfer Tec students entered Pratt in January of 1973, and are receiving free tuition for the initial year under the Sloan grant.

Pratt is currently seeking high school seniors, service veterans and transfer students from two-year colleges to encourage them to enter engineering.

For further information, contact Julius Randall, administrator, Sloan Foundation Grant, Pratt Institute, Brooklyn, New York 11205. Phone: 636-3583.

COLLEGE OF ENGINEERING
THE UNIVERSITY OF TENNESSEE
Knoxville, Tennessee

A PROGRAM FOR THE EXPANSION OF COOPERATIVE ENGINEERING EDUCATION TO INCREASE THE NUMBER OF MINORITY ENGINEERING GRADUATES

I. Purpose

A. To increase the number of engineering graduates at The University of Tennessee from among minority men and women.

B. To demonstrate that cooperative engineering education can be used to motivate these students for engineering study and thus overcome the traditional recruitment handicap which results from the lack of a minority engineer image for American youth.

II. Organization of the Program

A. Students to be Selected. A group of minority students is to be selected each year from among the high school seniors who are interested in and academically qualified for engineering careers. The number of such students will be determined by the level of support for this program from governmental agencies, business and industry.

B. Pre-Co-op Summer Employment in Industry. Students admitted into the program will be placed in industrial positions during the summer quarter immediately after graduation from high school. This period of industrial employment is to provide orientation and background knowledge about the work of the engineer through on-the-job experience. The students will be placed in companies which will provide continuing Co-op employment after satisfactory academic performance in the freshman year.

C. Management of the Program. Responsibility for administering the program will be assigned to the Cooperative Engineering Coordinator. Liaison with the academic departments of the College of Engineering will be provided by the faculty advisors, department heads, and the Associate Dean for Academic Advising. A special Co-op Engineering Counselor will be available to recruit minority students, counsel students in the Cooperative Engineering Program, and to arrange needed tutorial assistance. Placement of students in industrial positions during the pre-Co-op summer period and in the alternating quarters of full-time employment after completion of the freshman year is the responsibility of the Co-op Engineering Coordinator.

D. Work-Study Schedule for Minority Co-op Students. The work-study schedule for minority students in the Cooperative Engineering students at The University of Tennessee, Knoxville normally complete their senior year of study in consecutive quarters of full-time study. A pair of students fill a given industrial position after the two students complete the freshman year.

		Summer	Fall	Winter	Spring
Year 1	A Group	Pre-Co-op Work	School	School	Work
	B Group	Pre-Co-op Work	School	School	School
Year 2	A Group	School	Work	School	Work
	B Group	Work	School	Work	School
Year 3	A Group	School	Work	School	Work
	B Group	Work	School	Work	School
Year 4	A Group	School	Work	School	Work
	B Group	Work	School	Work	School
Year 5	A Group	School	School	School	School
	B Group	Work	School	School	School

III. Participation by Business, Industry, Foundations and Government Agencies.

A. Work Opportunities. Companies and agencies who recruit engineers and have employed Co-op students at The University of Tennessee will be asked to support the program by providing the pre-Co-op summer employment, making professional and managerial personnel available for orientation and career guidance during the pre-Co-op summer period, and providing engineering training assignments for Co-op student employees.

B. Grant-in-Aid Scholarships for Students. Students of the program are to receive grant-in-aid scholarships during the three quarters of full-time study in the freshman year, amounting to $750 per quarter. This amount applies to tuition; fees; tutorial, remedial and other instruction; housing; food; books, medical insurance. For the six quarters of full-time study during the sophomore and junior years, a $300 per quarter grant-in-aid scholarship will be provided to supplement the student's savings from earnings during work periods. Grant-in-aid scholarships of $500 per quarter will be provided for the students in the three quarters of full-time study in the senior year.

SCHOOL OF ENGINEERING
TULANE UNIVERSITY
New Orleans, Louisiana

SUMMER INTERN PROGRAM FOR MINORITIES IN ENGINEERING

The university has set itself the task of broadening the social and economic range of its educational impact. To do this, Tulane seeks to recruit and admit increased numbers of qualified but disadvantaged students at the university.

As part of this commitment, the School of Engineering is recruiting increased numbers of qualified minority students and has designed a Summer Intern Program for Students with Disadvantaged Backgrounds that will greatly increase the academic and eventual professional success of these students.

The Summer Intern Program consists essentially of summer employment for three successive summers of the same student by the same company. This format has the effect of a "summer co-op" arrangement.

The interns are placed for their freshman, sophomore, and junior summers with a company where they can work in an area closely related to their academic interest. Tulane has strong traditional programs in chemical, civil, electrical, and mechanical engineering. It also has a special Engineering Curriculum in which students can design individual programs in biomedical engineering, systems analysis, computer science, and environmental engineering, for example, and all of these represent areas in which the Tulane Faculty is doing significant research. The areas, therefore, in which an intern can specialize are numerous.

Each intern is assigned a faculty coordinator who closely correlates the student's academic and industrial experiences, and with whom the intern participates during the academic year in research design or educational technique studies.

The company pays the student for his summer work (an estimated total of $5,000 - $6,000 for the three-year period), assists him in obtaining housing, and helps him make the social adjustment that normally occurs when a minority employee begins work.

Tulane recruits and evaluates prospective students from minority backgrounds, but the school makes its final selections of summer interns with the assistance of the company. The university provides all the necessary scholarship aid, tutoring, and a faculty coordinator for each intern. Minority students at Tulane obtain assistance in their social activities from continuing university programs created specifically for this purpose.

If you are interested in participating in this program, please contact

Dean of Engineering, Tulane University
New Orleans, Louisiana 70118

indicating the number, the areas of specialization, and the home locations of summer interns that your company desires to sponsor.

SCHOOL OF ENGINEERING
TUSKEGEE INSTITUTE
Alabama

ENGINEERING AT TUSKEGEE INSTITUTE

Following World War II, five predominantly black engineering schools were established to meet the rising expectations and demand for minority professionals. Tuskegee Institute, a private coeducational institution founded by Booker T. Washington in 1881, initiated an Electrical Engineering program in 1948. A subsequent addition of a Mechanical Engineering curriculum in 1955 and a complete re-organization of faculty and curricula in 1960 launched the School of Engineering on a program of innovative changes. Its early accreditation by the ECPD in 1965 recognized the quality of its graduates as well as its potential for a healthy and vigorous growth. The initiation of graduate programs in 1961-62 spurred the growth of the faculty and sponsored research and provided motivation to students. At that time, Tuskegee had the largest number of Ph.D.'s on its faculty of all black engineering schools. As a result, over 60 percent of Tuskegee's engineering graduates subsequently earned at least a M.S. degree which exceeds the national average. The academic rigor has stimulated enrollments and the output has correspondingly risen from 9 Baccalaureates in 1960 to 35 Baccalaureates and 15 Masters in 1972.

Tuskegee was also the first to recognize the benefit of Cooperative Education, especially, the relevance and reinforcement which black students received in addition to direct financial assistance. In fact, in 1967 a Pre-Coop program was put into effect at Tuskegee which was later successfully used at other institutions and companies. At present, 40 percent of the engineering enrollment (approximately 300) at Tuskegee follows the Cooperative Education path.

In efforts to attract more black students, Tuskegee initiated a "3-2" Dual Degree Program in 1961 with several UNCF institutions. In a characteristic boot strap operation, Tuskegee has managed to expand the program geographically to several southeastern states and the Virgin Islands and, more significantly, has produced three graduates in spite of almost total lack of financing. While the "3-2" program cannot be viewed as providing a major artery for a large throughput of black engineers, Tuskegee views this opportunity as a useful though limited alternative. Similar flexibility is now applied to the Junior College Transfer "2-3" Program.

Numerous examples of success are characteristic of the 92-year old history of Tuskegee's experience in compensatory education. Among recent successes, special emphasis must be given to a healthy student involvement through peer group recruiting and peer group tutoring and counseling. Recent experience has shown the value of the higher credibility which students bring to recruiting and the confidence and encouragement which a fellow student naturally generates with inexperienced lower division students.

There are many good engineering programs in the country, but few have displayed such understanding and compassion for the problems faced by black students and have succeeded so much with so little support as Tuskegee Institute where Tradition reinforces Innovation.

SCHOOL OF ENGINEERING
VANDERBILT UNIVERSITY
and
FISK UNIVERSITY
Nashville, Tennessee

DUAL DEGREE PROGRAM

Fisk and Vanderbilt universities have established a new academic program which will allow qualified Fisk science students to earn a second bachelor's degree with only one year of extra work.

The new program - intended to increase the numbers of black professional engineers - is scheduled to begin on a pilot basis with 10 students this fall. Dr. George Neely, Jr., chairman of the Fisk physics department, and Dr. Howard L. Hartman, dean of the VU School of Engineering, will serve as coordinators at their schools.

Under the plan, a student could earn - in about five years - a bachelor's degree in chemistry, physics or mathematics from Fisk and a bachelor's degree in an undergraduate engineering discipline at Vanderbilt.

Through its Committee on Educational Aid, E. I. DuPont de Nemours and Co. has provided $15,000 to fund the program for the first two years. A DuPont spokesman said it was hoped the "dual-degree program" will succeed in "attracting minority students to enter the field of engineering."

In the program, a student would be enrolled in a science curriculum at Fisk for the first three years. Then, through cross-registration, he would take introductory courses at Vanderbilt, and during his fourth and fifth years he would study at both schools.

COLLEGE OF ENGINEERING
WAYNE STATE UNIVERSITY
Detroit, Michigan

MINORITY ENGINEERING PROGRAMS

Wayne State University is located in the center of the City of Detroit and serves primarily a three county region. There are approximately 33,000 total students; almost 20% of them are black. The city itself is approximately 50% black and it is natural to expect that the university would provide significant service to this community. The College of Engineering has about 1,400 students and approximately 8% of them are black. A number of programs have been instituted recently either to recruit additional minority students or provide additional services to those enrolled.

I. Recruitment and Financial Assistance Programs

A. The college annually hosts a regional Science and Engineering Fair competition. Approximately 400 to 500 community junior and senior high school students participate annually by preparing and submitting their work. Although Wayne acts as host and provides some of the operational staff, the program itself is one part of six such regional fairs, and some of the staff for the program at Wayne comes from local community and industrial personnel.

B. There has been formed in the college an Association of Black Engineers and Applied Scientists which among other things assists our college admissions office in preparing and carrying out recruitment programs both at local high schools and on campus. These programs consist of student and faculty presentations discussing general opportunities in engineering and specific programs at Wayne.

C. The college has established a cooperative education program which has a special industry-supported scholarship program attached to it. Young blacks are offered a freshman year scholarship which pays essentially all of their expenses, to be followed by four years of a cooperative job with the local industry that provided the scholarship.

D. An eight week summer experience for high school juniors, carried out cooperatively with local industry, provides potential black engineering students with four weeks in industry and four weeks at the university with nominal summer pay for their expenses.

II. Special Support Programs

A. Each summer 12 to 15 students whose academic records are not adequate for normal admission to the College of Engineering but

who have expressed considerable enthusiasm for engineering careers are invited to spend the summer in an intensive upgrading program taught by Wayne's staff. All students completing the program are admitted to the college. The summer program provides them intensive study in mathematics, the sciences and in learning-study skills. Our experience indicates that it is definitely possible to boot-strap some people.

B. The Association of Black Engineers and Applied Scientists and a number of faculty donate their time for formal and informal tutoring activities for those students who need extra academic assistance.

U. S. ATOMIC ENERGY COMMISSION

PREFACE PILOT PROJECTS, SUMMER 1973

The Nuclear Education and Training Division's concern that its programs should reach out more effectively to students who have experienced a deprived educational environment has lead to PREFACE (Pre-Freshman and Cooperative Education). This is an AEC-sponsored, multi-agency funded program to provide enriched learning opportunities to student participants. Its purpose is to increase the number of engineering and science graduates, especially from minority and disadvantaged backgrounds. It relies upon projects designed locally with the assistance of personnel knowledgeable about educational and employment conditions in the immediate vicinity.

PREFACE pilot projects provide the student with a tailored education and/or work experience during the summer following high school graduation, followed by enrollment in a typical academic freshman year program, leading into the more traditional Cooperative Education programs with alternate periods of study and employment in the field.

During FY 1973, the AEC provided partial financial support to the following four PREFACE pilot projects: Howard University, University of New Mexico, Ohio State University, and Tuskegee, with a total of about 60 students. Financial support came from HEW, university, private foundation, and industrial funding, with AEC contributing $50,000 or approximately one-third of the summer costs. During the Summer, 1973, the Ohio State and New Mexico students are employed in industrial or university jobs; the Howard enrollees are spending six weeks at the AEC's Argonne National Laboratory; and the Tuskegee students are doing course work on campus supplemented by visits to nuclear reactor activities at Oak Ridge, Savannah River, TVA, and private utilities.

Virtually 100% of the participants seem assured of at least partial financial support during their Freshman engineering studies, with further support still being explored.

The future of the program depends upon the success of the pilot projects, the degree of interest in participation by colleges and employers, and the availability of funding for both the summer and the Freshman year. The AEC expects to have the basic PREFACE concept incorporated in the on-going cooperative education programs at various AEC sites.

The AEC recommends that all educational institutions and industrial and other employer groups participating in cooperative education programs should adopt the PREFACE or similar pre-coop concepts. The program has much promise for all students, but appears especially important for recruiting minority and disadvantaged individuals into undergraduate students. The engineering field is already facing a shortage, which minority group recruiting can help alleviate as well as help solve the national need to provide equal opportunity to all individuals.

DOW CHEMICAL U.S.A.

MINORITY PROGRAMS

Student Workshop - College juniors are invited to spend two days at Dow with one day in a manager's office and the second in a shop, plant or lab directed by that manager. Although not specifically directed toward minorities, a large percentage of the group is planned to be minorities.

Direct Assistance to Black Universities - Dow works closely with five black engineering schools by financial grants, gifts of new or used equipment, Dow products and consultants to improve programs. Dow is especially interested in upgrading curricula and educators.

Restricted Grants to White Universities - Grants are given to ten predominately white institutions to cover special programs for attracting minorities to engineering careers.

Resource Persons - Professional engineers and scientists give programs in colleges and high schools for career guidance and serve as consultants to a professor for a class, lab or project.

Technical Co-op Program - Approximately 25 persons, of which half are minorities, are enrolled in technical co-op programs. Dow is attempting to encourage women to enroll in the program. This includes guarantee of employment for work periods from the second year through the fifth year, and transportation costs between Midland and the university.

High School Counseling - Dow participates in career days for high schools in its areas to interest students, especially minorities and girls, in a career in engineering with one program beginning in ninth grade.

In-House Design Program - Engineering and Construction Services at Houston sponsors in-house training programs for drafting and designing. Several graduates of the course are enrolled in night courses at the University of Houston leading to their degree.

IBM

PROGRAM FOR ENGINEERING EDUCATION FOR MINORITIES

As a part of its larger program of aid for minority education, IBM has devoted substantial attention over the past several years to help strengthen engineering and engineering technology programs at black institutions as well as special programs for minority students at a few other selected colleges and universities.

The program includes grants to institutions and a faculty loan program through which professional personnel may accept teaching or administrative assignments.

Direct grants have been made to Tuskegee Institute, Southern University, North Carolina A&T and Tennessee State for the general support of their engineering schools and to Howard to aid in the development of a new curriculum in urban systems. A grant has also been made in support of the dual-degree program between Georgia Tech and the Atlanta University Center.

Under the Faculty Loan Program, for the academic year 1973-74, IBM will loan 33 specialists to 25 colleges with large enrollments of minority or disadvantaged students.

Through the Technical Education Consortium, IBM has provided support and assistance to five minority colleges to enable them to offer programs of electromechanical technology. The institutions include Texas Southern, Alabama A&M, Florida A&M, Washington Technical Institute and Haskell Indian Community College. Aid has included a 1401 computer system with tape and disk drive to teach and demonstrate electromechanical technology. Funds have also been provided for development programs for faculty, student financial assistance, and special aid in recruiting technically talented students from poor families.

IBM participates in "college/industry cluster programs" which operate on campuses of the traditionally black colleges.

In addition to specific support for science and engineering students, IBM provides general undergraduate scholarships for minority students, for example, 50 one-time $1,000 National Achievement Scholarships for Outstanding Negro Students.

In addition to these various activities, IBM also participates in the special minority programs of various engineering organizations and associations, such as the American Society for Engineering Education.

MOBIL OIL CORPORATION

"WEEK IN THE BUSINESS WORLD" PROGRAM

For the sixth consecutive year, Mobil has held its "Week In The Business World" Program for sophomore students from selected Black colleges and universities. The Program was established in 1968 in an effort to give Black sophomore students an opportunity to visit Mobil's New York Headquarters and various field operations in the New York-Philadelphia area. The Mobil Program gives students first hand knowledge of:

- real career opportunities in business
- how a large corporation functions
- educational requirements, employment procedures, and interviewing techniques among corporations
- the experiences of graduates from traditionally Black colleges who are working in business

During the early part of each year, arrangements are made with the Placement Office of selected Black institutions to publicize Mobil's Program and develop candidates from the sophomore class. Interested students complete a datasheet and write a short essay on why a week in the business world interests them, and what they might gain from it. Mobil's recruiting representatives visit each campus in the early spring and based on a personal interview with each candidate, and an evaluation of the candidate's essay, finalists are selected to represent each participating school. For the years 1968 through 1972, the Program involved twenty Black institutions; however, in 1973, the number of schools represented was twenty four. The Program is usually scheduled for the week immediately preceeding Easter starting on Sunday evening with a reception and dinner, and ending on Good Friday. All participants' expenses in connection with travel, lodging, and related expenses are paid for by Mobil.

The "Week In The Business World" Program consists of discussions with functional managers, tours of various company facilities (research, manufacturing, accounting, and marketing), career orientation sessions related to the student's individual interests, and opportunities to meet and talk with graduates of Black schools who are currently in Mobil's employ. In addition, the participants are given free time for sightseeing and relaxation, including a group dinner at a New York restaurant and a Broadway show.

The following quote from one of this years' participants summarizes the value of Mobil's "Week In The Business World" Program:

> "The opportunity to participate in this Program is about the best thing that could have happened to me at this time. It has given me some ideas about what is available for me in careers".

UNION CARBIDE CORPORATION

MINORITY PRE-CO-OP PROGRAM FOR HIGH SCHOOL STUDENTS

A program to encourage the entry of black students into science and engineering studies was undertaken in the summer of 1969 by the Nuclear Division of Union Carbide Corporation. Five black universities recruited about 26 high school graduates each year for the program and Union Carbide provided summer employment prior to the students' first year of college as well as books and tuition during the freshman year. Students then entered cooperative education programs of alternate study and work after their freshman year in college. Schools involved were: Howard University, North Carolina A&T State University, Southern University, Tennessee State University, and Tuskegee Institute.

A report reviewed the activities and results of the pre-co-op program through its first three years of full operation. Seventy-eight students entered the program during the three-year period and 59 are still active. An additional ten students are still in college but no longer participate in the program. Only nine students of the original group are no longer in college and four of the nine are in military service. Of the 59 active students, 40 are engaged in engineering studies and 19 in science. Ten of the active participants are women and 49 are men.

Contact: Mr. W. C. Kuykendall
Coordinator of Minority Pre-Co-Op Program
and
Manager, Employment and Recruitment
Nuclear Division, Union Carbide Corporation
P. O. Box M
Oak Ridge, Tennessee 37830

XEROX CORPORATION

SCIENCE CONSULTANT PROGRAM

PROGRAM DESCRIPTION

The Xerox Science Consultant Program consists of technical professional employees, known as "consultants". On a bi-weekly basis they visit inner city schools to present science projects to intermediate grade students. Through the use of props, manipulative materials, and experiments the consultants design lessons that stimulate interest in both science and learning.

PURPOSE

The program is presently serving ten schools including a school for the deaf and a high school. Approximately 3,100 students are involved. These students are predominently Black and live in the ghetto areas of the city. In these areas conventional approaches to education are unstimulating and demotivating, and are insenstive to the problems related to ghetto life.

The basic requirements of a consultant are that he have technical expertise and a desire to work with children. However, to be wholly successful, the consultant must also be sensitive to the particular problems associated with educating these students. Through his understanding of these probelms, his imagination and ingenuity, he creates an atmosphere that encourages the students' creativity and stimulates their imagination.

ORGANIZATION

Approximately seventy employees participate in the program on a voluntary basis. Also, a full-time coordinator administers the program on a budget of approximately $45,000, and a four man committee provides guidance and overall program direction.

The program is designed to supplement the schools science curriculum. Close cooperation between the teacher and consultant is necessary for the program to operate effectively.

SUMMARY COMMENT

The SCP has proven to be successful in the seven years of its existence. This is evident through the attitudes of the students themselves. In addition, the SCP provides Xerox with an outlet for community involvement.

AMERICAN GEOLOGICAL INSTITUTE

MINORITY PARTICIPATION PROGRAM

The Minority Participation Program (MPP) in the geological sciences has been established by the American Geological Institute (AGI), in an attempt to rectify the gross imbalance of minority members within the geological sciences. The term "minority" is used here to mean Black Americans, Spanish-surnamed Americans (principally Chicanos and Puerto Ricans) and American Indians.

Principal Goals of the Minority Participation Program

- to inform minority students of career opportunities in the geological sciences
- to help minority students enter and graduate from courses of study in the geological sciences
- to establish geological science programs in colleges with an enrollment predominantly of minority students, where these students have a substantially better chance of achieving success
- to retrain as geological scientists minority faculty members who may be under-utilized at present, such as agricultural scientists, as the fastest and most economical way to involve more minority students in the geological sciences

PROGRAM IMPLEMENTATION

Retraining Black Faculty Members

Only a few courses in the geological sciences are available at colleges with predominantly minority enrollment, but most Black land-grant colleges and other minority institutions have science faculty members who are now utilized poorly, primarily due to declining student interest in agriculture. These instructors, if retrained as geological scientists, could provide a ready source of professional and technical training for minority students enrolled at these colleges.

Proposed Retraining Program

1. Black institutions will identify faculty members interested in retraining as geological scientists.
2. The selected faculty members will study the geological sciences for one academic year and two summers, including field work, at universities with well established departments.
3. MPP will provide the financial assistance required for relocation, housing and subsistence and academic fees, while the participating institutions will cooperate by granting faculty leave for the training period and by agreeing to offer geological science courses to their students.

4. The newly retrained faculty members will return to their home institutions and teach at least one course in the geological sciences. If feasible, they will work toward establishing a geology department.
5. During the retraining period MPP will act as counsel to the faculty members to aid them in their professional growth and to assess the accomplishments of the program.

Concurrent Assistance to Minority Members

The initial effort of MPP will be to promote the retraining as geological scientists of some minority faculty members from other scientific fields. MPP will also foster student interest in the geological sciences, prepare rosters, and survey and analyze data related to counseling of minority students. While the first faculty members are being retrained, MPP will proceed with its other objectives in a continuing effort to increase minority participation in the geological sciences.

SUPPORT FOR THE PROGRAM

Initial financial support for MPP has come from the Institute's member societies, from individuals, and from the Charles E. Merrill Trust.

The Merrill Trust has funded the first year's staffing of MPP and the feasibility study of retraining faculty members from other scientific disciplines in predominantly Black institutions. A number of host institutions, are committed to the retraining program and are prepared for the arrival of minority participants as early as September 1973.

The Minority Participation Program needs substantially greater financial support if its goals and activities are to be realized. The MPP Advisory Committee and staff are now seeking other sources of funds.

ASPIRA OF AMERICA, INC.

Aspira of America, Inc., a national organization is now in its twelfth year. Through affiliate organizations, educational and leadership development counseling programs have continued to serve the Puerto Rican communities of New York, New Jersey, Pennsylvania, Illinois and Puerto Rico.

Aspira offers Puerto Rican students a network of services designed to foster aspiration, awareness, knowledge and a commitment to the Puerto Rican community. The Puerto Rican student is given a chance to succeed, is given the training and support needed to work towards realistic educational goals. His Aspira Club gives him a chance to communicate with his peers; gives him a sense of security and unity; gives him the right atmosphere to develop self-confidence.

Each affiliate serves communities with different needs. In both New York and Chicago, Aspira is running its own demonstration bilingual schools, with curricula designed to fit the needs of the community; and in Philadelphia, Aspira worked with the local Board of Education in a recruitment and training program for bilingual teachers.

The experimental CREO (Creating Resources for Educational Opportunity) Program, administered by Aspira of New York, under a two-year grant from the Office of Economic Opportunity in Washington, completed its first year of operation. High school juniors who had previously attended school sporadically, if at all, now stay for tutoring sessions after school, and their grades show a marked improvement.

The Aspira School, administered by Aspira of Illinois, under a grant from the Chicago Committee on Urban Opportunities, was designed for Puerto Rican high school drop-outs. This was their second chance. With intensive bilingual courses, the majority of these students passed their high school equivalency tests and have been admitted to college.

Aspira of Pennsylvania took part in the Philadelphia Board of Education's program to train and recruit bilingual teachers for high schools with a predominance of Spanish-speaking students. Aspira recruited 18 former Aspirantes for this progressive program Candidates took courses during the summer at Temple University and in September were placed as bilingual teachers in the school system.

Aspira of New Jersey opened a second center to service those Puerto Ricans who live too far from Newark. Several towns surrounding Newark have substantial Puerto Rican communities, including Hoboken, Camden, Jersey City, Paterson, and Perth Amboy. The second New Jersey center is located in Hoboken, reaching the Hudson County area.

The National Health Careers program has had another successful year. Of all the professional needs of the Puerto Rican community, the need for doctors is perhaps the most critical. There are currently fewer than 60 Puerto Rican doctors practicing on the Mainland where, on a proportionate basis, there should be 1,800. Our National Health Careers program at the graduate level this year helped 14 students gain admittance to medical school. This figure may not seem impressive on its own, but one should consider that, according to the Association of American Medical Colleges, the national enrollment of first year mainland Puerto Ricans in medical school for 1971-1972 totalled only 40 students. Thus, the Aspira group represents a 38% increase in Puerto Ricans entering medical school nationally.

A key function of the national office is to provide training and technical assistance to the affiliates. Week-long training seminars conducted at each affiliate by the Director of Training and Programs were very well received. Regional Board members also participated in these sessions.

NATIONAL MERIT SCHOLARSHIP CORPORATION

NATIONAL ACHIEVEMENT SCHOLARSHIP PROGRAM
FOR
OUTSTANDING NEGRO STUDENTS

The National Achievement Scholarship Program for Outstanding Negro Students was established in 1964 by a grant from the Ford Foundation to increase educational opportunities for able black students. It is a national talent search program that is administered by the National Merit Scholarship Corporation.

Objectives and Participants: The Achievement Program has three primary objectives:

To identify and honor the academic accomplishments of black secondary school students and to give them public recognition;

To offer financial aid to outstanding black Finalists in the National Achievement Scholarship competition whose need is such as otherwise to preclude the college or university opportunity; or who are judged to be capable of unusual contributions which can be best realized at colleges of their first choice; and

To encourage the educational attainments of a large number of black students who participate in the Achievement Program by identifying them to colleges, universities, companies, foundations and organizations that may wish to assist them in obtaining a college education.

Some 55,000 students from nearly 6,000 schools are participating in the most recent Achievement Scholarship competition. About 1,000 students emerge as Finalists each year and are, thus, eligible to compete for about 350 (number limited only by sponsor support) available scholarships.

Sponsor Participation: Sponsored Achievement Scholarships have been financed by business corporations, foundations, colleges and universities and others. In the nine Achievement Programs to date, awards valued at approximately $8 million have been made to Achievement Scholarship winners, each of whom was determined by criteria established by his/her sponsor who underwrote the winner's scholarship cost at a minimum cost of $250 per year ($1000) and a maximum of $1500 per year ($6000), depending on financial need of the winner. (A $200 administrative service fee is added.)

Student Participation and Eligibility Requirements: To participate, a black student must take the Preliminary Scholastic Aptitude Test/National Merit Scholarship Qualifying Test (PSAT/NMSQT) in his high school and indicate in a space provided on the test answer sheet that he/she wishes to be considered in the Achievement Program. Simultaneously, the student becomes a participant in the Merit Program.

College Mailings to Participants: On a cost basis, NMSC makes it possible for regionally accredited United States colleges to mail information about their institutions to the home addresses of the approximately 8,000 highest-scoring Achievement Program participants. These lists include the nearly 3,400 black students who qualify as Achievement Semifinalists or Commended students and about 4,600 others who indicate their desire to attend college. Proposed major fields of study are also indicated. (This service must be requested between October 15 and November 15.)

For additional information write: National Achievement Scholarship Program
National Merit Scholarship Corporation
990 Grove Street
Evanston, Illinois 60201 (#312/869-5100)

AMERICAN SOCIETY OF CIVIL ENGINEERS

MINORITY PROGRAMS

Members of ASCE became interested in promoting training programs for the disadvantaged of minority groups when its San Francisco Section in 1968 joined several engineering societies to organize its first on-the-job training program for the disadvantaged. This consisted of the instruction in the fundamentals of drafting and jobs in established engineering firms where the practical phase of drafting could be experienced. Trainees became full-time employees of the firms for which they worked and for the first 11 weeks divided their time between the classroom and the office. A similar program was set up not long after this when the ASCE Metropolitan Section (New York) joined other societies in organizing the Joint Urban Manpower Program (JUMP). Both programs are now financed by USDL funds for administration, job related education, and subsidized wages for the first 11 months.

Other sections, realizing the importance of offering equal opportunities to the minorities, have several variations of the San Francisco and New York programs. Interest increased until the ASCE Board of Direction established the Committee on Minority Programs (COMP) on November 8, 1971. A description of COMP follows:

Charge: "The committee shall promote local section and national activities that will encourage the education and training of disadvantaged minorities in engineering and related disciplines; foster the employment of such minorities at all levels of skill and training within the engineering field; and direct the expertise of engineers to the solution of the special social and economic problems faced by such minorities."

Implementation: "To forward the objective of COMP as stated in the charge COMP will develop discussions for national, regional and local meetings, and proposals for action by the national and local bodies of ASCE; it will offer assistance and guidance to the various bodies of ASCE in promotion of practical programs designed to forward the above objectives. It will seek to develop cooperative efforts with other professional societies in pursuance of these objectives."

Goals: 1. Actively seek out and encourage minority engineers to join ASCE and retain their membership; become involved in ASCE's Section activities; and assist in developing minority programs.

2. Develop programs for encouraging minority use to obtain the education necessary to become engineers or technicians.

3. Find ways to maximize employment of qualified or trainable minorities.

4. Enlist the volunteer services of engineers in their areas of expertise to meet the needs of disadvantaged minority communities.

Needs for Programs For Disadvantaged: It is evident that there are thousands of young people whose training for a livelihood has been neglected. It is believed that engineering societies can play an important part in making it possible for these youngsters to train for positions as paraprofessionals or technicians in the engineering and architectural fields, and those, who qualify, to take full engineering courses leading to a college degree. While this program was not primarily started to fulfill an affirmative action plan, it does have that capability. The on-the-job training program is a natural way for firms to implement their affirmative action plans. By developing this type of program companies can make their affirmative action plans a reality. This program meets the employment needs of both the engineering profession and minority groups.

ENGINEERING MANPOWER COMMISSION
OF THE
ENGINEERS JOINT COUNCIL

MINORITY PARTICIPATION IN THE ENGINEERING PROFESSION

The Engineering Manpower Commission of Engineers Joint Council, as part of its continuing program to assess supply, demand, and utilization factors involving engineering and technological manpower, views women and racial minorities as an underutilized resource whose participation in the profession should be encouraged.

The Commission has an ongoing program of collecting and publishing enrollment and degree data, including the numbers of women, negroes, and other minorities if feasible, included in the totals.

EMC maintains liaison with other organizations involved with women and minorities in engineering in order to keep abreast of developments affecting engineering manpower. The Commission has published a special bulletin, "Women in Engineering," and "Minorities in Engineering," the proceedings of a meeting on that subject in November 1972.

THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

MINORITY ACTIVITIES

The Institute of Electrical and Electronics Engineers (IEEE) is in the early stages of summarizing activities focused on increasing the participation of minorities and women in engineering. These activities are under the leadership of the Committee on Professional Opportunities for Women and the Minority Committee of the Educational Activities Board. The IEEE is, of course, a member of the Engineers' Council for Professional Development and supports, therefore, its extensive guidance program and its general relationship with the minority engineering education effort (ME^3).

Specific IEEE minority-oriented activities will focus on guidance and motivation of minority students, the involvement of minority IEEE members in the activities and leadership of the Institute. Further attention to this important work will be given in the February, 1974 issue of the IEEE "Transactions on Education" which will focus on minority engineering education.

Information relating to IEEE minority activities is available by contacting

Dr. Julia Apter
Rush Medical College
1753 West Congress Parkway
Chicago, Illinois
60612

Mr. John M. Kinn
Director-Education
Institute of Electrical and Electronic Engineers, Inc.
345 East 47th Street
New York, New York
10017

Dr. Lindon E. Saline
Manager Corporate Education
General Electric Company
P. O. Box 151
Ossining, New York
10562

LOS ANGELES COUNCIL OF BLACK PROFESSIONAL ENGINEERS

MINORITY PROGRAMS

Five years ago the Los Angeles Council of Black Professional Engineers was formed. The Council's stated purpose is to develop interest among elementary, junior and high school students, potential college, and college students from the minority communities in the pursuit of engineering as a profession. Because of the comparatively small number of blacks and other minorities in the technical fields, we do not consider recent nationwide de-emphases on aerospace-defense-oriented employment to be a valid deterrent to the counseling of disadvantaged youth to enter these fields. Rather, we feel there is a vast reservoir of unexploited potential talent in these communities which can effectively and deservedly be channelled into these fields of science and engineering.

To this end, the Council has created programs to further its objective of increasing the number of minorities in engineering. They include the following:

1. Operations Pipeline which is comprised of four separate programs.
   a) Visiting elementary schools so that the students may identify with minorities in the profession.
   b) A pilot program in Applied Science Awareness in two South Central Los Angeles high schools. The instruction for this program was provided by a student enrolled in a local engineering college.
   c) Visiting high schools and junior colleges on Career Days.
   d) A pilot program of Engineering Education for Minority Students. This spring (1973) the Council, in conjunction with the American Society of Civil Engineers, approached the eight local engineering colleges in the basin area with a program proposal. Plans are rapidly underway to form a consortium among the several schools to place 160 students per year in the engineering programs in the area (approximately 20 students per campus per year). The Council's prime area of responsibility shall be to find deserving and capable students.

2. Summer Work Exposure Program through which the Council assists students during the last years of their school effort by finding summer employment for the students who have committed their studies toward engineering.

MINORITY ENGINEERING EDUCATION EFFORT (ME^3)

Secretariat: Engineers Council for Professional Development and other cooperating organizations

Program: The Minority Engineering Education Effort is the designation for a secondary school guidance program being launched by a task force which includes representatives of more than a dozen educational, engineering, business and minority organizations.

Its major activities will be directed toward early identification of engineering aptitude and interest, motivation, building prerequisite skills and assistance toward college entrance. Specific short-term goals are to help bring about a 50% increase in the number of minority engineering freshmen in the fall of 1974. Long-term goals are directed toward achieving a minority participation in engineering proportional to their representation in the general population. This is translated into the objective of increasing the number of graduating minority engineers by a factor of 10-15 in the coming decade.

Financial Aid: Initial funding was provided by the General Electric Foundation. The Guidance Committee of the Engineers Council for Professional Development also contributed with some of its resources. AT&T has provided staff support including the Executive Secretary to the task force, who is on detached assignment from them.

Information Contact:

Dr. L. S. Senhouse, Jr.
Task Force Executive Secretary
Minority Engineering Education Effort
Engineers Council for Professional Development
345 East 47th Street
New York, NY 10017

APPENDIX IV - PART A

ADDRESS BY DR. MYRON TRIBUS

MINORITIES AND TECHNOLOGY - THE HIDDEN PROBLEM

Ladies and Gentlemen: It is a privilege and a pleasure to be asked to speak to you today. You need no exhortations from me. Your presence here expresses a commitment which bespeaks of the best that is in you. Once this nation's challenge was to develop its natural resources, but the geographic frontier has now disappeared and the challenge has changed. It has been replaced with a new challenge--the development of human resources. One of the great pleasures of life is to meet a fully developed human being. I have met a few--Ralph Bunche in the UN, Joe Wilson in Xerox--and each encounter has left a deep impression. The endeavor to develop each individual human being to his highest potential is the noblest effort men can undertake. This is the challenge which has replaced the frontier. Indeed, this challenge is the reason for your meeting. And that is why this chance to talk to you is such a privilege.

This conference is concerned with the education of minorities, and specifically with the challenge of helping them to find careers in the sciences and engineering. It is well to look at this challenge from two perspectives. First of all, there is the problem of bringing educational opportunity to minorities. Then there is the larger problem of bringing non-technical people into a healthier relation to technology. This challenge you are addressing has many antecedents and will not end in our lifetime.

There is an urgency about this problem, specific to the professions,

that suggests that you are meeting in critical times. What we succeed in doing now has enormous implications for the future of our society. The harvest that is reaped in 1990 will be bitter or sweet depending upon what is sown today.

The difficulties with which we grapple today are the result of actions and inactions by our fathers, grandfathers and their grandfathers. These were not evil men. They were ignorant--just as we shall probably be judged to have been ignorant two generations hence. The challenge, if we are to be regarded differently by our descendants, is to see beyond our immediate problems and to understand what we are doing to ourselves, our children and our nation. Gunner Myrdahl warned us of this a generation ago in *"The American Dilemma."* He warned us that unless we solved the problem of race, our nation would one day be destroyed by it. The challenge is not only to our courage, our will and our decency--the challenge is also to our willingness to learn, to adapt, to give up cherished notions and prejudices. To do so will require that we look at what we are doing in the widest possible context. We should begin by attempting to connect our current perspective with the historic past and visions of the future.

The word minority today is used to cover quite a few people. Generally, we mean any group which has been left out of the mainstream of American life. Today that means Blacks, Chicanos, Indians, Puerto Ricans--and even that new non-silent majority, women. The problems women face in entering engineering are different--so different that I shall not touch upon them further on this occasion. That subject calls for a separate conference.

There are really two problems which face minorities--one is a purely racial problem--growing out of the failure of many Americans to accept and recognize one another on the basis of genuine worth. The other problem stems from what has been called the "culture of poverty." I believe we have made some headway in recent years with the first problem, and I believe we can make even more progress with it in the future. No one should claim that prejudice based on color has vanished, but I believe it can be made to disappear in one more generation. But we shall have to continue to work at it. However, the problems which come from the culture of poverty are much harder to overcome. I believe you will find as you proceed with your sessions that many challenges arise not because a person is black, or red or brown or yellow, or even rednecked. They arise because of problems which are spawned by poverty. These two problems--the racial and the poverty--are connected, of course, for discrimination on the basis of race makes escape from the culture of poverty that much more difficult and tends to perpetuate the image of minorities as underachievers. But unless we focus on the problems which arise from poverty, we shall not solve either problem.

Stan Smith, until very recently a senior vice president with G. E., has put together a significant analysis of the problem as seen by industry. Smith tells us that most of the major corporations of the U. S. have wholeheartedly adopted the policy of eliminating discrimination in hiring, promoting and rewarding employees. I believe his analysis is correct. Of course, the systems are run by humans, with all that is implied in that fact, and there are pockets of resistance--but the movement is genuine.

Within G. E., for example, Stan Smith points to programs begun in the '40's. I remind people under 30, that's before you were born. I assume the Xerox position, established by Joe Wilson and maintained by C. Peter McColough, is known to you. It requires constant attention and vigilance, but that's what leadership is all about.

As a result there has been significant progress at the lower levels. As Smith has observed:

> *"In hourly paid assignments - which have relatively modest educational requirements - minority people are not only getting on the payroll, but they are qualifying for increasingly skilled and responsible assignments."*

I can do no better than to draw further from Stan Smith at this point: From his perspective, he finds that progress is not coming nearly as fast in the exempt-salaried ranks. In the technical, professional and managerial jobs, the minorities are sparsely represented. This is also true in my own organization. Furthermore, I am deeply concerned that our managers may not be able to reach their minority employment goals in these areas no matter how hard we try. Our goal is to have minorities equitably represented in <u>all</u> jobs and at all levels throughout our Research and Engineering Division in direct proportion to their numbers within the labor market. We have made good progress in the past two years, but we still have a good distance to go.

<u>A Problem of Supply</u>

I share Smith's concern that much of the rhetoric of militancy and government compliance still speaks about "knocking down barriers" and "opening up jobs" for Blacks and other minorities in the upper levels

of industry. But that is decreasingly the problem. The record does show that managements of the large companies, the big employers in the industrial field, are working hard to remove the formal and informal barriers and are demanding results. We want to see working minority people on the payroll in influential professional and managerial positions. In fact, there is a very lively competition for qualified minority people, with the demand far exceeding the supply. Herman Kahn has pointed up this fact recently: The willingness is there; the jobs are there; but how do we develop the qualified minority candidates?

In the eagerness to remove the barriers of prejudice, this problem has been ignored, or perhaps deliberately swept under the rug. As Smith says, the real problem today, in professional and managerial levels, is not one of demand, but of supply. He goes on to show that it takes special education and special training to qualify for many positions in our highly complex industrial society. No matter how hard a man or woman may be willing to work, no matter what his native talents may be, he cannot do competent engineering work without a knowledge of engineering. He cannot do important financial work without the necessary education and financial training.

Persons with engineering or financial training provide the main volume streams of our professional employment. Until industry can get large numbers of qualified Black engineers, Blacks cannot become a significant element in top professional and managerial ranks. The same is true of women, and what I have to say also applies to the problem of upward mobility for women in industry.

Consider this: Of the people in the top 20% of our exempt salaried

ranks in a typical large technical company, more than 60% have a 4-year technical degree. These people with technical degrees work in virtually all the professional functions of the business - manufacturing, engineering, research and development, marketing, and relations work - and they provide a majority of our managerial leadership.

Performance, not Parentage

Stan Smith points out that many minority people are skeptical of the need for professional education in modern industry, that many of them are convinced that moving into a position of leadership is primarily a matter of the right family, the right school, the right connections. It is said, for example, that all we need to do to get the right proportion of Blacks in our top management ranks is to set the pattern by appointing a few Jackie Robinsons. But Jackie Robinson had the talent and skill to be a big league ballplayer and was not placed in the lineup merely because he was Black.

The statistics from the payrolls of major technical corporations are similar. Of 102 top executives, 75 came directly out of college, 10 came within 5 years of graduation, and the other 17 spent anywhere from 5 to 23 years with other companies. They represent a wide range of social, geographic, and economic backgrounds, and family connections are rare. They're from a wide range of schools; in fact, there are schools represented that some of us never heard of.

The point is that most publicly-owned corporations have a tradition of people succeeding because of their performance, not their parentage, or their stock ownership, or their school tie. But a prerequisite for professional or managerial success in modern, technically

oriented companies is education suited to the requirements of the business, and these requirements dictate that the volume streams of opportunity require engineering or financial competence.

Industry Wants Greater Minority Participation

Now, as a matter of fairness - social justice - public acceptance - a healthy society - we want to see minority faces emerging in the leadership of industry. We're not neutral about it; we're eager to get the job done.

In addition to the crucial reason of providing equal opportunity for all, there are added business reasons for wanting to recruit and develop Black leadership. The key reason is simply that we need Black leadership and white leadership. We need the best people we can get, in volume, and we defeat our own self-interest by being limited by the artificial distinctions of race. And that is why we must emphasize the need for a many-fold increase in minority engineering graduates. You will hear these statistics in many ways.

A Formula for Tragedy

Of 43,000 engineers graduated in 1971, only 407 were Black and a handful were other minorities or women - 1%. It takes about 15 to 25 years for people to rise to top leadership positions in industry. So if industry is getting 1% minority engineers in 1972, that means that in 1990 that's about the proportion that will emerge from the competition to the top leadership positions in industry. Not 5%, or 10%, or 17%, but 1%.

This is a formula for tragedy. Long before the year 1990, a lot of minority people are going to feel that they have been had. Already there are angry charges of discrimination with regard to upward mobility in industry, whereas the real problem, clearly visible today, is that there just aren't enough minority men and women who have taken the college training to qualify for professional and engineering work.

According to a study of Blacks in engineering by Lucius Walker of Howard University, only ½ of 1% of the engineers in the nation were Black in 1960 - and that proportion did not increase at all by 1970! Out of 230,000 students enrolled in engineering in 1970, approximately 1 out of 100 were Black, with 70% of these enrolled in the predominantly Black schools. The number of freshmen Blacks enrolling in engineering increased 19% in 1971, which is a good sign. But Lucius Walker points out that if the present number of Blacks graduating from engineering schools is increased by 15% a year, 50 years would be required to achieve proportionate representation in the nation's engineering force - that is, a Black for every 9 whites. On the present lazy trajectory, we are postponing the arrival of significant number of Blacks in the top ranks of industry until well into the 21st century.

Needed: Ten-Fold Increase

To put the challenge bluntly, unless we can start producing not 400, but 4,000 to 6,000 minority engineers a year within the decade, industry will not be able to achieve its goals of equality, and the nation is going to face social problems of unmanageable dimensions.

What can be done?

There has been much talk of job restructuring. A certain amount of that can be done, and openings can be made for minority technicians without the full range of engineering education. But these jobs will not be a major source of professional and managerial leadership in the future, any more than they are today.

From time to time, one hears hints that we in industry might drop our standards, hire unqualified people, perhaps even call them "engineers." Then if they fail in the competition for leadership, that's their fault, not ours. What a sorry game!

First of all, it can't be done for competitive reasons. Our competitors here and abroad have first-rate engineers, and we can't compete with second-raters. The waste and inefficiency would knock us out of business. The United States is having trouble enough in international competition, without adding the problem of unqualified engineers.

No Double Standards

And furthermore, the Blacks and other minorities would quickly see through the sham and resent it. Listen to the words of Dr. Kenneth B. Clark, distinguished professor of psychology and a member of the New York Board of Regents. Highly regarded as a Black spokesman, Dr. Clark had this to say about industry standards of performance:

> *"I cannot express vehemently enough my abhorrence of sentimentalistic, seemingly compassionate programs of employment of Negroes which employ them in Jim Crow double standards or special standards for the Negro which are lower than those for whites. I think this is a perpetuation of racism, is interpreted by the Negro as condescension, and, as I told a group of psychologists and industrial leaders*

yesterday, will be exploited but will not contribute to any substantive, serious, non-racial integration of minorities into the productive economy of business."

Industry must maintain high standards of performance for all persons.

Perhaps it has crept into our mind that we might be able to get away with excuses. We in industry could prove that we are hiring our fair share of the available population of minority engineers, and pass the buck along to the engineering schools. Engineering educators could point to their programs to attract Black enrollments and demonstrate that the problem lies with the Blacks. They just don't sign up for engineering. And the Blacks would place the blame on a white society that they would believe discriminates against Blacks in professional work. And then the situation would stand exactly where it is today. And meanwhile, we would have lost that precious time, with disastrous consequences for all concerned.

Only Acceptable Solution

The only acceptable solution is to take bold, innovative, all-out action to increase the supply of minority engineering graduates not by a few percentage points, but 10 or 15-fold, and to get it done within the decade. This is the only way we can expect to see acceptable proportions of minority men and women in the top ranks of industry by the end of the century.

I have drawn heavily from the observations of Stan Smith, for he gives the challenge in quantitative terms. Now let's look at it in human terms.

Why don't more Black students come into engineering? The answer

does not lie in their blackness. It lies in other causes. One I call "the old reality of engineering." Another is the culture of poverty. The same is true of Chicanos, Puerto Ricans or Indians.

The Old Reality of Engineering

Compare those Black engineers with their Black brothers and sisters who chose medicine instead. The percentages show the difference: 1.5% of all U. S. physicians - some 5,000 in all - are Black; 7% of all U. S. physicians are women. In engineering on the other hand, according to Mr. Walker's data, which I cited earlier, only about ½ of 1% of the engineers in the nation are Black. These figures suggest that medicine, as opposed to engineering, is a relatively attractive professional avenue for minority people. And, of course, this makes sense. The bright young Black and the bright young woman are attracted to medicine because he or she knows that one day he or she will be able to practice! Until not so long ago, that same bright student could not be so certain about a career in engineering. "Why knock myself out in engineering school, for an uncertain future, when I can elect medical school instead. If I make it there, I can have my own practice, and serve my own people. And never will I be beholden to the big, bigoted industrial companies for a livelihood."

I say we have a long way to go, we in industry and we in the world of engineering education, before this image is totally gone. Until we do this, we will not see significant growth of the nation's Black engineering population.

The Culture of Poverty

I would like to put the "culture of poverty" issue into an historical framework, looking backward at causes and looking forward to consequences.

It is my thesis that the problem is much larger than the racial issue and that in another generation, it will recur with a much different appearance, but the same underlying cause.

First consider recent history: Looking backward we can see that the current situation was predictable. When this country vigorously applied science and technology to the farms, it made farm labor redundant. The natural tendency for people to flock to the cities was intensified. The problem was recognized by the Roosevelt Administration at least 35 years ago. Prior to World War II, particularly under Eleanor Roosevelt's prodding, some small starts were made to move education and opportunity to the country in the hopes that people would stay there. But the need for labor in war industry put a stop to those efforts. The need for workers in the rapid industrial expansion immediately after the war and the mechanization of the farm made the flux of people irreversible. This flux became a flood during the Eisenhower years when the country was most interested in "getting back" to peacetime pursuits.

The cities were ill prepared to cope with the influx. It was a grim retribution--the city folk had been unconcerned with the education or opportunities available for children in the country. These children then grew up and came to the city, largely unprepared for what was required of them, and became the city's problems.

Martin Luther King often reminded us that while the majority of Blacks was poor, the majority of poor people was white. It's still true. Therefore, as we consider problems which arise from the culture of poverty we should recognize we are not really talking about the racial problems of minorities.

The basic problem of the child born into the culture of poverty is the inability to see the opportunities life affords. The child's self-image is shaped by what he sees around him. The child who sits at the dinner table each night with an engineer has less trouble thinking of himself or herself as an engineer than the child who has never met an engineer and doesn't even know what an engineer is and does.

Some years ago the National Urban League commissioned the creation of a film for teenage Black school children. The purpose of the film was to show that there are Black doctors and Black dentists and Black businessmen et al. And as its "vehicle" it starred a young Black boy who spent the day visiting the Black doctor and the Black businessman, etc. The movie's first scene showed the boy at breakfast with his mother and father and they talked about what the day was going to be like. Then off they went to visit with each of the professionals, who talked in turn with the boy about "what it was like" to be a doctor, etc. This approach is the normal adult approach to teaching children.

When the film was completed people at the Urban League decided to have a test showing at a local (mostly Black) school. Two or three classes were shown the film and then the children were asked to talk about what they had seen, etc. Well, it turned out they had absorbed very, very little of what they had seen on the screen. Nobody could remember that there had been a doctor in the movie. Nobody remembered that Black businessman and what he did, etc. After some probing, it turned out that the kids--almost universally--had totally lost the point of the movie...because all of them were caught and mesmerized by that opening scene, where the little boy and his folks sat down and had breakfast together. They just hadn't seen anything quite like

that before and apparently they spent the rest of the movie thinking back to it.

Any attack on the problem of recruitment of minorities into the profession must begin here.

The essence of living in poverty is the short view. Life beyond the next welfare check or the next season is beyond the planning cycle. When you are a prisoner you do not plan; you live from day to day. That's what our Vietnam POW's taught us. To plan you must feel that you are in control of your destiny. But if you are in the culture of poverty, this is precisely what you do not feel. If you are above the poverty level, it is natural for you to plan what you will do with your life. If you are at the poverty level, the route to escape is to rebel. To escape from the poverty level you must make up your mind to be different from the people around you...the people who do escape are, by definition, different. Crime is one route and we should not be surprised if many people attempt it. It is almost self-evident that if we wish to diminish criminality, we must not only make crime unattractive, we must also provide attractive alternatives to a life of crime: How many Black boys found the road to crime in the same way Malcolm X found it? In his autobiography, Malcolm tells of the high school teacher who "advised" him to be "practical". Young Malcolm, a good student...indeed, later in life he would develop into a man of brilliance...wanted to pursue one of the professions. But that teacher told him to choose something practical, such as carpentry, because the professions were closed to "his kind."

The question "Am I my brother's keeper?" is an ancient one. We have learned that it is a simplistic question. The question is not

whether we are responsible for one another. We are. The question is how that responsibility is to be exercised. We know that too much help is counterproductive...that the best kind of help is that which helps others to help themselves. Help consists, sometimes, in not doing something to people as often as it consists of doing things for people. It is better to show a child how to tie his shoes than to tie them for him. It is better to help a youngster to make his own way than it is to pay it for him. The key to escape from poverty lies in education; but it does not lie in education in the conventional sense.

It is at this point that I wish to make the connection with the future. A leading educator in France, Dr. Bertrand Schwartz, made the following observation to me: In France, he said, we seem to be creating two classes of people. It starts in primary school where some of the children believe in what the teacher is saying and try to learn whatever she tells them. The other children have no belief in the value of what they are taught and they resist. They learn the minimal amount. Both groups are passed on to the next level where the process is reinforced. Those who have already learned find it easier to learn and those who have not are further disadvantaged. The process continues until the first legal age for leaving school is attained. One group, being convinced of the value of education, continues on to higher education, to positions of prestige and power, positions where the education really does matter. The other group finds employment where education isn't needed. They are thus reinforced in the belief that education is of little value.

Schwartz observed that this has always been the case but that with the growth of technology, the opportunities for uneducated people have diminished. It is necessary for people to go back to school in order to keep pace with the demands of industrial life. But those who do not believe in education do not perceive of the classroom as a place where anything of value is imparted. The further complication of life by more and more technology promises to aggravate this situation. Schwartz considers the impact to be destablizing - it is certainly difficult to see how to maintain such ideals as the consent of the governed and participatory democracy if a sizable segment of the population becomes innoculated against continuing education and is forced to live in an advancing, highly technical society.

The problem is by no means confined to France--we have it here in the USA in a massive way. I believe our problems of racial prejudice are masking us from the true magnitude of these problems. We confuse problems of race and problems of poverty. We cannot see where we are going.

The approach we take to the education of disadvantaged minorites may, therefore, set a pattern from which much can be learned about the problems 20 years or so ahead of us--the education of those who are innoculated against education.

The causes and the cure lie in education, but education more broadly conceived than heretofore. We must learn to consider the total environment--not just the experiences within the walls of the schools.

Lawrence Kubie, the famous psychiatrist, once observed that the decline of the farm and the small family business has meant that the

American family has moved from being a producing unit to being entirely a consuming unit. The only thing the family shares together is consumption. Children do not have the opportunity to be useful to anyone else during their entire growing up period. In our desire to protect our children, we have gone too far.

The problem is universal and international. I recall an international conference with the Russians. As usual we tried to get to know one another through an interpreter, but mutual suspicions reduced the level of the conversations to formal and stiff interchanges. Only once did I feel that I had broken through the barriers and was speaking man to man, heart to heart. This was when I said to a particularly gruff Bolshevik, "I know what is your most difficult problem." Despite the language barrier I could tell his annoyance as he shot back, "And just what is our problem?" "It is what to do with your children now that you have protected them from the things which made you strong." His expression left no doubt that we had at last reached common ground.

The problem with our approach to general education, and this is particularly difficult for the disadvantaged poor, is that it is designed as a preparation for a distant life--it is not immediately relevant to the world as it is seen by the children. Childhood is a period of impatience and the inability to postpone pleasure is a characteristic of immaturity. The child of the ghetto has difficulty in seeing why he should not be gratified now. The solution does not lie in instant gratification--it lies in helping the child see <u>why</u> it is worthwhile to wait. That value judgment may best be taught in the environment outside the classroom.

Sooner or later those who worry about the future come to education as the answer. It is a short step from there to blaming the schools for all the ills of society. But I am suggesting something else...I am suggesting that the schools need to be augmented as well as changed. The augmentation should be via a different institution, one which helps students to cope with the here and now, while the schools help them to prepare for the future.

Different experiences are appropriate for each age level. I am not suggesting a repeal of the child labor laws. To exploit child labor for profit in these days is criminal. But to bar children from participation in the necessary work of society is equally criminal. Children need to be needed...our overprotective treatment of our children has made them feel like aliens in a foreign land - unnecessary - and, therefore, by inference, unloved.

While these problems are descriptive of all children, they are true especially of the children in the culture of poverty. A program to assist them must not only be concerned with formal schooling--it must be concerned with the time outside of school. There must be a chance to appreciate and understand the world beyond the experiences of poverty. There must be a chance to participate in that world, and thereby to imagine that one is a part of it. There is no way to guarantee that every child in the culture of poverty will elect to escape from it. But unless we are there to mark the escape route, to make it clear, in terms which the child can comprehend and believe, that the escape is possible for him, only negligibly few rebels will escape.

In my own organization we are supporting such programs as our Science Consultant Program where 57 of our research and engineering people make bi-weekly visits to the classrooms of 11 schools in Rochester. Control Data Corporation has a post-high school technical education course which it provides free to people in some ghetto communities. Metropolitan Life Insurance Company has developed a high school cooperative program, 70% of whose participants are lured on a full-time basis. The Morgan Guarantee Bank has a tutoring program for underachievers. In the schools of engineering we hear of still more programs. At Carnegie-Mellon, at Drexel (where, I understand, General Electric people have been working with members of the Drexel faculty), at Georgia Tech with its cooperative program with the Atlanta University Center, where the objective is to produce 60 Black engineering graduates in 1976...up from 3 in 1972.

There are people at this conference who can tell us in detail about programs such as these, as well as other approaches to augment education. They will have a most receptive audience. There is a strong desire to move; one can sense this in both worlds--in industry and in the schools. In that sense, this conference must succeed.

Our challenge then is to look beyond the racial issue and come to grips with the needs of those who are seeking an escape from poverty. We must offer them a new kind of education, an education that affects the self-image of the youngster...an education that instills in him the belief that his efforts will be rewarded, that he can succeed.

I believe the surest way is to help him find a role in which he can feel that he is useful...useful to himself, to his family, to his

society. For our Black citizens, our Chicano citizens, our Indians, we must help restore the pride that has been taken from them. We do this for them, but in the largest sense we do it for ourselves, for our nation, for our future as a free people.

CLOSURE

The issue is larger than just the development of the human resources of 10 or 15% of our population. It is bigger than even the avoidance of strife and bloody revolution, such as has befallen unhappy Ireland. These are big enough issues. But in the long run you are pioneering the path towards stability in the post industrial society. You are facing the challenge of creating a philosophy of education for a technical society. Your job is to invent an educational model that will be attractive, stimulating and rewarding to people who are conditioned against technology, who fear technology. As you learn to do this with minorities, keep in mind that the techniques you develop will also apply to the education of the majority. Both depend--majority and minority alike--on technology for survival. Yet neither knows nor cares.

Good luck on your deliberations. We are all dependent on your success.

APPENDIX IV - PART B

ADDRESS BY PERCY A. PIERRE

Thank you.

Ladies and Gentlemen, I would like to take only a few minutes of your time to outline some of the conceptions which went into the planning of this symposium, some of the things we learned in the process and some of the decisions which led to the format we have today. First, I would like to give you some background on how the planning effort developed.

In August 1973, the Commission on Education invited me and others to discuss with it what role the National Academy of Engineering might play in increasing minority participation in engineering. It was suggested, and the Commission agreed, that a symposium would be a good first step. Having done this, it was necessary to develop a document setting forth the proposed symposium, its rationale, its procedures and its expected output. This document was prepared and revised many times but was finally approved by the Academy.

A planning group was organized to develop the details of the symposium. At this point, we must acknowledge the work of Mrs. Jean P. Moore, who from the beginning, has assisted in coordinating the production we are about to see. Mrs. Moore is Staff Assistant to the Chairman of the Commission. She has been the focal point for the gathering of information and advice from the great number of persons who have been consulted. However, her work is not done yet. She will be very visible over the next couple of days in helping to hold the Symposium to some semblance of rationality in addition to making sure that everyone gets fed.

In describing the planning for this effort, it helps to view it in three parts. First, the program structure - what should we talk about? Second, the program participants - who should we ask to do the talking? Third, the Symposium participants - who should come to talk back to the talkers?

Deciding the program structure involved dealing with the issues. First of all, we decided on a workshop format so that there would be room for considering any issue the participants wanted to raise. However, it would have been irresponsible of us not to isolate some issues on which we would do some home work. These are the major topics of the Symposium. Much discussion went into the development of this program. I would just like to call attention to one fact which permeated all of our discussion, namely: the predominantly Black engineering schools must make a major contribution to this effort.

In choosing program participants and symposium participants, we wanted first of all to get those individuals who would have something to say about their own on-going efforts. When we started we did not know how large a group of people this would be. We did know that for the last two years, there have been significant increases in Black freshman enrollment in engineering in the face of significant decreases in white freshmen enrollment. We didn't know whether this had just happened or whether there were some folks out there doing something. At this point, I would say it is the latter, in fact enough folks to fill this Symposium.

Having discovered this, we knew that our original conception of a symposium involving the widest possible participation had to be cut back. Thus, you will find that most of the program participants and the symposium participants are already in the business of producing minority engineers.

This is one reason why the Symposium does not devote a lot of time to the question of why should we increase minority engineers. However, we realize that this is an important question which certainly will come up again and agin.

We are aware of inadequate representation of several groups that could contribute to and benefit from the discussions we will have. These include: (1) high school teachers and counselors, (2) minorities other than Blacks, and (3) students both at the high school level and in college. However, this symposium is only a first step. One of the next steps for the Academy might be another symposium. You may decide on a different vehicle for getting the word to all of those others we know should be aware of our discussion.

A final word about the impact we expect this Symposium to have. I think it has already had a positive impact by focusing the interest of a large number of people on this problem. The interchange of information which will occur here will add to that impact.

However, these are short-term benefits. Many of us are committed to a larger goal. That goal is full representation of minorities in the engineering profession at all levels. That goal will not be achieved by incremental improvement. It will take a major effort by many organizations and individuals.

This brings me to the importance of the recommendations you will leave with us. These recommendations should be commensurate in scale with the task as you see it and addressed to those who can get the job done. At the same time, they should be serious recommendations which we fully expect to see carried out.

Let me welcome you and wish you an enjoyable and productive Symposium.

APPENDIX IV - PART C

ADDRESS BY SENATOR HUBERT H. HUMPHREY AS ENTERED INTO THE *CONGRESSIONAL RECORD*

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Senate

EXPANDING MINORITY PARTICIPATION IN ENGINEERING

Mr. HUMPHREY. Mr. President, on May 7, I addressed a special National Academy of Engineering symposium on minorities in engineering. I think that when we look at the poor national performance in promoting minorities to top professional leadership positions, we must look to a totally inadequate minority participation in engineering as an important part of the problem.

Given the predicted shortage of many categories of engineers in the next few years, it would be irresponsible if a serious effort were not made to fill a good portion of this gap with talented people from our minority groups.

I believe that the prime second generation civil rights problem of the 1970's is the slow progress of minorities into top levels of management. If we can produce more minority engineers in the 1970's, we will have a "seedbed" of talent for top level management positions in the 1980's and beyond.

I ask unanimous consent that my remarks to the National Academy of Engineering on May 7 be printed in the RECORD.

There being no objection, the address was ordered to be printed in the RECORD, as follows:

EXPANDING MINORITY PARTICIPATION IN ENGINEERING

America has made great progress in the civil rights area in the last decade. The most dramatic and important achievement has been related to jobs. Without an equal opportunity for decent jobs and income, I think we will all agree, there is little chance for full participation in other areas of society.

In one area, however, minority progress has been relatively slow. That is in the upper professional and managerial ranks. This, I believe, is the prime second generation civil rights problem of the 1970s. Unless it is addressed, inequality in our society will grow.

Engineering training has traditionally been and is today a key requirement for many of the upper level professional and managerial positions to be found in businesses and government. The current participation rate of minorities in the engineering field, however, is shamefully and distressingly inadequate:

98% of U.S. engineers are white males, a group which comprises only 42% of our population.

A group of 36 million Americans—blacks, Indians, Chicanos and Asians—contribute less than 2% of the U.S. scientific and technical personnel.

Women represent less than 1% of engineers.

Of 1.1 million engineers in 1971, only 7,300, or .7%, were black.

Out of 230,000 students enrolled in Engineering in 1970, only 1 out of 100 were black.

According to the experts, this country is headed for a severe shortage of engineers in many specialties within the next few years. If the quality of life for a growing population in an increasingly complex world is to be improved, this gap must be filled. This could be done in a number of ways. However, it would really be irresponsible, with this timely gap in the supply of engineers, if we failed to fill a large part of it with minorities and women. We must!

Of course, this will not happen on its own. A massive concerted effort by industry, government and our educational community is called for.

Why should we try to meet the anticipated demand with minorities? Some of the most important reasons are:

To reduce economic discrimination and provide potential managerial and professional leaders in the future from our minority groups. It takes 15 to 20 years to rise to top positions; we must not waste time.

To tap a valuable source of human capital that has not been fully utilized in the past, particularly in engineering and the hard sciences.

To provide a cadre of technically trained minority people to help find technological solutions to the socio-economic problems of the central cities, where many of these people have their roots.

To prevent the recurrence of a "brain drain" of engineers from foreign countries where their skills are urgently needed. And

To increase the number of non-white Americans available to respond to the technology needs of the third world.

Most agree that the problem of getting more minority engineers into industry, education and government is a supply problem, not one of demand. While equal opportunity legislation has succeeded in inducing demand, it is not being met by the educational establishment.

A number of related problems have been pointed to as the reason for the lack of trained minority engineers in the U.S. Some of the most important seem to me to be:

Inadequate preparation for engineering schools by inner city public schools (poor facilities, especially for sciences, poor curricula in math and science, insufficient guidance counseling, etc.).

Minorities have been generally unaware of opportunities in the engineering profession.

All too few successful engineering leaders from the minority community to serve as models for the careers of the young.

The economic condition of most minorities makes any advanced education difficult to obtain. When that education requires longer hours in school for laboratory work—making outside employment difficult to arrange—this economic problem is compounded.

The community colleges and predominately black institutions that most minorities attend have generally not been adequately funded to provide quality engineering education.

Another serious related problem is the lack of technically trained minorities at the top managerial and professional levels of industry, government and education. Besides the obvious reason that there is only a limited pool of lower level minority engineers in these organizations to put into the leadership positions, other reasons have been noted. Some of these are:

Rigidities in the promotional and seniority systems of public and private sector organizations:

Small number of the minority engineers with educational backgrounds that can compete with their peers who attended the U.S. "centers of excellence" in engineering. And

The persistence of bias in most organizations at many levels, despite the official policies of these institutions.

Now, what can be done to correct this situation, to improve the supply of minority engineers and see to it that they are given fair treatment in moving up in our private and public institutions?

It seems to me that today's symposium is a major step in the right direction. The first step is to recognize the problem, develop a strategy for dealing with it and mobilize a broad spectrum of business, education and government leaders to work together toward a solution.

I don't have any quick and easy solution to offer. I wish I did! The people in this room are much more qualified than I to chart the right course.

I do have a couple of ideas, however.

First, it seems to me that a series of regional consortia for minority engineering education might be established. With minority education in the lead, minority educational institutions could develop cooperative programs with the various "centers of excellence" in engineering around the country.

This would provide minority students with an opportunity to avail themselves of the facilities and expertise of these institutions and provide the "centers of excellence" with a pool of qualified minority students to draw into their programs. Exchanges of professors, opportunities for joint appointments of faculty, with research opportunities for all, would improve the quality of education at all consortia institutions. Perhaps, a series of federal "institution building" grants could be provided to the minority institutions to expand engineering faculties and finance needed facilities.

Second, a "blue ribbon" task force could be established with leaders of industry, government, and education as members. This group, with minorities in the lead, would be responsible for focusing public attention on the minority engineering problem. They would emphasize the growing shortage of engineers and rising demand for minorities in this field.

Third, this National Academy of Engineering group could establish direct contact with guidance counselors in secondary schools in areas with large minority populations. Minority students, more than most teenagers, are cut off from a view of what career opportunities exist in the country.

Providing information on future demand for engineers, industry demand for minority engineers, importance of the engineering profession in the solution of inner city socio-economic problems, sources of financial assistance for engineering education, could go a long way toward stimulating more interest in engineering among the growing number of well trained minority youth in our high schools.

Finally, it seems to me that the best way for industry to get more minority engineers in their drafting rooms is by putting more minorities in their board rooms. Unless the possibility of rising to the top can be demonstrated to talented young minorities, they will choose other professions for their careers.